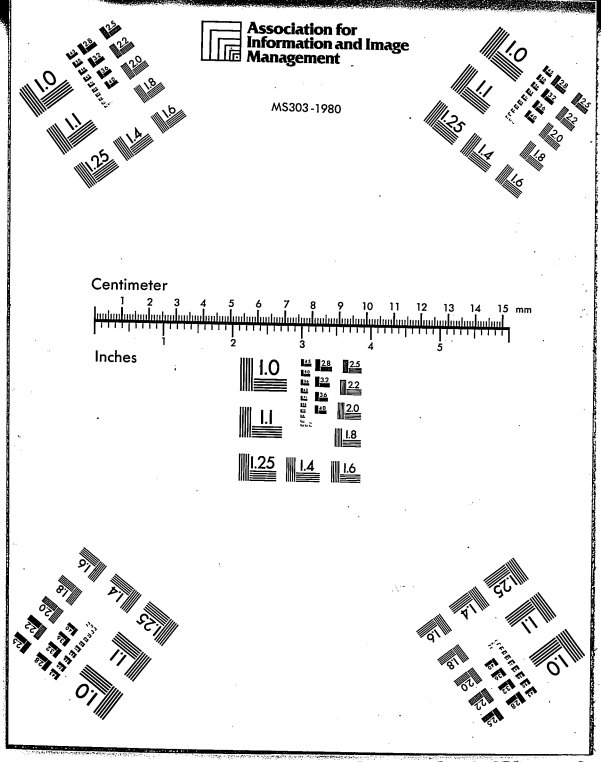
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A SELECTIVE MICROFILM EDITION

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(1879–1886)

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1987

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THOMAS A. EDISON PAPERS

A SELECTIVE MICROFILM EDITION
PART II
(1879-1886)

REEL 41

NOTEBOOK SERIES (NBK-19)

Menlo Park Notebooks, #220 - end

Menlo Park Notebook #220 [N-81-07-11]

This notebook covers the period July 1881. The entries are by Charles L. Clarke and relate to dynamos. Included are notes, calculations, and drawings of the London C dynamo, the Z dynamo, and various central station dynamos. Several loose pages were found in the book, including calculations and notes by Clarke and Gustav Soldan on dynamo design and a note from Edison to Clarke asking for the size of wire used on the Z dynamo for the Edison Machine Works. The label on the front cover is marked "Magnets." The book contains 278 numbered pages.

Blank pages not filmed: 6-13, 66-278.

X E-172 N-81.07.11

Dynamo Z. Clinton. July 11. 1881.

Upright Dynamo –

Magnets – size of A dynamo.

Armatures – $\frac{14}{100}$ wire wound.

With 60 lamps of 1.15 ohms resis. the external resis. is 1.92 ohms and with $\frac{14}{100}$ in armature and 110 volts external the total E.M.F. is 110 + 8 = 118 volts and there is considerable drop due to polarization.

If 125 volts were required on the regular medium machine it would require a magnet current of 17 webers. The no. of turns of

wire was 1380 and therefore the magnetizing power was

$1380 \times 17 = 23460$

The magnet is 42" long and $6\frac{1}{2}$" diam.

Suppose we use 200 lbs. of No. 17 B.W.G. ($\frac{58}{1000}$" diam.)

The total length will be 19600 feet and resistance 60 ohms.

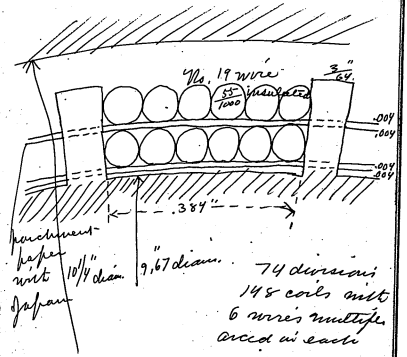
and with $1\frac{3}{4}$ ft of wire for a turn the total will be 11200 turns of wire.

At this rate the magnetizing force will be $11200 \times \frac{110}{60}$

$= 20500$

The foot lbs. required would be $\frac{(110)^2 \times 44.3}{60} = 8900$ ft. lbs.

Clarke. Aug 4. 1881



C - No. 2 - Linden Dynamo.

The length is increased from 33 3/4" to 44 1/2" over C - No. 1. for Paris.

This gives an increase of 32% in E. M. F. efficiency.

The two extra magnets added to C - No. 1 gave an increase of 20% in efficiency and four extra magnets would increase this efficiency to 40%.

This 40% gain will be upon a length of 33 3/4" for armature. The total gain will therefore be 72%.

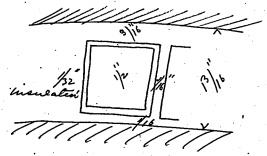
Clarke, Aug. 15. 1881

In C-no.1 there were 73 commutators, with 72% gain in efficiency the number can be reduced to

$\frac{100}{172}$ of 73

$= 43$

The space in C-no.1 when increased from $\frac{2}{16}$ to $\frac{5}{8}$ or $\frac{1}{16}$ shew a decrease of efficiency at 100 Volts of less than 2%



Assume it to be as high as 3% then for an increase of 3/16" in the space the loss in efficiency will be 9%. Suppose this loss to be in the original efficiency of 100 We have a total efficiency of 163%. The commutator can be reduced in number from 73 to

$$\frac{100}{163} \text{ of } 73$$
$$= 45$$

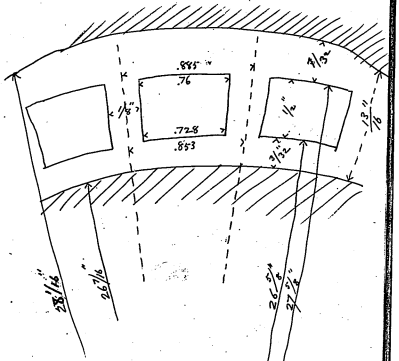
Assume them to be 49 in number. and 98 bars

On a basis of 8 magnets as this 100 per cent we have for no. of commutators

$$\frac{120}{163} \text{ of } 73 = 53$$ ~~bars~~ Commu

or 106 bars. See page 35.

Clarke Aug. 15, 1881.



Cross section of bar .372 sq. in.

Clarke, Aug. 15, 1885.

The total resistance of Armature of C No. 1 as measured before bars were reduced in size was .0085 ohms.

The bar had following dimensions

and area = .2192 sq. in.

Total length of bars 42.7"

Cutting length 33.75"

Diff. 8.95"

The bars in London machine will have a length of

45 + 8.95 =

53.95"

The resistance of bars in C No. 1 as calculated is .0048 ohms.

The London machine will have a resistance in the bars of

$$.0048 \times \frac{53.95}{42.7} \times \frac{.2192}{.372} \times \frac{49}{73} =$$

.0024 ohms.

In dynamo C No. 1 the total resis: being .0085, the resis: of the copper discs is

.0037 ohms.

There are 73 in each end with a thickness of .0065" and insulation of .02.

Total space allowed is 6.225"

$$\begin{array}{r} 4.22 \\ \hline 9.84 \\ 3\,54 \\ \hline 44 \\ 26 \\ \hline 18 \end{array}$$

$$\begin{array}{r} 48 \\ \hline 4.38 \\ 33 \\ \hline 146 \end{array}$$

$$\begin{array}{r} 2.112 \\ \hline 1.92 \\ 192 \\ \hline 48 \end{array}$$

With 49 discs and 50 insulations each .02 we have $6.225 - 1 = 5.225$ for discs $\frac{106}{1000}$.

The nearest B.W.G. gauge is No. 12 $= \frac{109}{1000}$.

49 of this is 5.341"

Remaining .884"

and for each of 50 insulating discs .0177".

The resis. of copper discs of $\frac{65}{1000}$ having been .0037 ohms the resis. for 49 of $\frac{109}{1000}$" will be $.0037 \times \frac{49}{73} \times \frac{65}{109} =$

.00148 ohms.

The total resis will be

$.0024 + .00148 =$

.00388 ohms.

Clarke, Aug. 15. 18[illegible]

With 1200 lamps of 140 ohms each the joint resis. is .1167 ohms

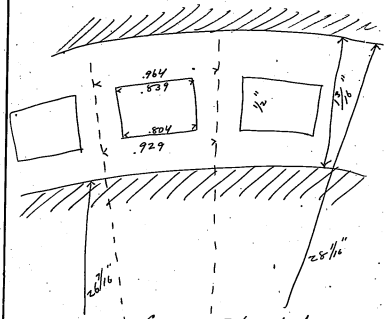
The ratio of internal to external resistance will be 1 to 30.

1200 lamps will be 120 Electrical H.P. which will require the loss of 4 H.P. in armature.

Cleveland Aug. 15. 1881.

See page 19 –

Assume 45 commutators.
and therefore 90 bars



Cross section of bar
.41075 sq. in.

Clarke, Aug. 15, 1884.

The resistance in face of armature will be

$$.0048 \times \frac{5-3.95}{42.17} \times \frac{.2192}{.41075} \times \frac{45}{73} =$$

.001963 ohms.

With 45 discs of No. 11 $= \frac{120}{1000}$" the insulation can be $\frac{18}{1000}$".

The resistance will become

$$.0037 \times \frac{45}{73} \times \frac{65}{120}$$

$$= 0.001236$$

Total Armature Resis.

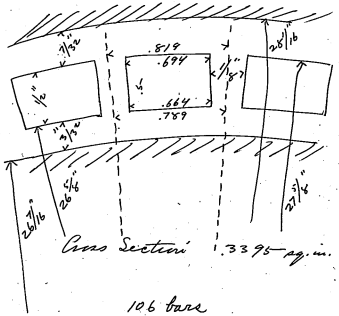
$$= .001963 + .001236 =$$

.003199 ohms.

Ratio of internal & external with 1200 lamps = 1 to 36/k.

Clarke, Aug. 15 - 1881

Assume 5-3 commutator.



Cross Section .3395 sq. in.

106 bars

Copper discs $\frac{1.02}{1000}$" thick

No. 10 B & Sharp.

Resist. in face of armature will be

$$.0048 \times \frac{53 \cdot 95}{42.7} \times \frac{.2192}{.3395} \times \frac{53}{73}$$

$$= .00284 \text{ ohms.}$$

There will be space for 53 copper discs each No. 10 B&S $= \frac{102}{1000}$" diam. and $\frac{15}{1000}$" insulation

Resist. =

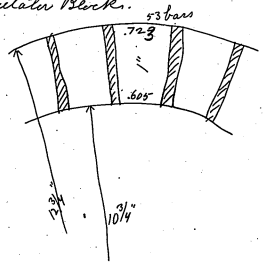
$$.0037 \times \frac{53}{73} \times \frac{65}{102}$$

$$= .00171 \text{ ohms.}$$

Total resist = .00455 ohms.

Aug. 18, 1881

Commutator Block.



Lamps 8 per horsepower at 102 Volts have a resistance

$$R = \frac{102^2 \times 44.3}{4125}$$

$$= 112 \text{ ohms, nearly}$$

The London dynamo with 800 of these lamps gave 102 Volts external at 320 revs. The joint resis. of 800 lamps was .14 ohms and with .049 ohms in armature supposing no other resis. in circuit, the total E.M.F. was $\frac{102 \times .1449}{.1400}$

$$= 105.6 \text{ Volts.}$$

At 350 revs. this would be 115.5 Volts.

The 12 magnets were in series of 6 with total resis. for the six of 12.225 ohms.

The magnetizing power can then be represented for one magnet by

$$\frac{102}{12.225} \times (4 \text{ layers of wire})$$
$$= 33.3$$

~~In the Paris dynamo [illegible]~~

If the magnets had had six layers of wire as in the Paris dynamo and we wish for same magnetizing power we have

$$\frac{x \times (6 \text{ layers of wire})}{19.05} = 33.3$$

$x = 105\ 3/4$ volts

or for each magnet

17.6 volts.

Clarkes, Oct. 11, 1881

The horse power on magnets was

$$\frac{17^2 \times 44.3}{2.0375} \times 12$$

$$= 75400 \text{ ft-lbs.}$$

The gain by increasing diam. of cores from 8 to 9 inches would be $\sqrt{8}$ to $\sqrt{9}$

2.83 to 3

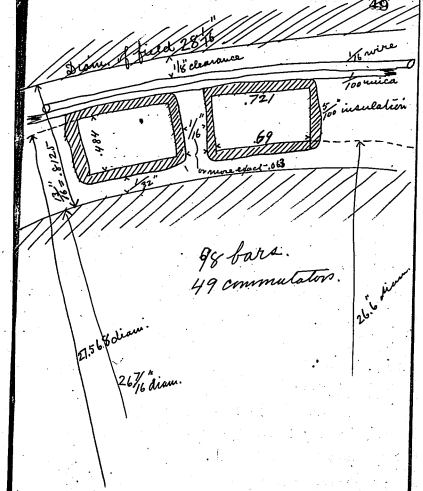
1 to 1.06.

6% gain.

Clarke Oct. 11, 1888.

Dynamo Central Station.

Clarke. Feb. 11. 1881.



The area of a copper rod is
(end) .34146 sq. in.
In London Dynamo it was
.3395 sq. in.
an excess of $\frac{6}{10}$ % in Central
Station Dynamo.
The commutator are reduced
from 8 to 49 - and
~~equivalent~~ lengthened from
$44\frac{1}{2}$" to 49". to allow for
increasing cores from 8" to 9"
diam. The copper discs
if increased in proportion to
decrease in no. of commutators
increase in thickness from
.102 to .110 ; by adding about
$\frac{1}{64}$th we have .120 = No. 11 B.W.G.

Use ~~[illegible]~~ insulation ~~as before~~ between discs $\frac{10}{1000}$" thick.

Make $\frac{1}{32}$" insulation between first copper disc and iron plate (both inside and outside discs).

Bars in London Dyn. average length 53.95. In this dynamo average length will be increased by 4" and the space of insulation and will be near enough for calculation as 58".

The resis. of the bars of the armature will be

$$\frac{98}{4} \times \frac{58}{12} \times \frac{8.1132}{341460}$$

$$= .00317 \text{ ohms.}$$

The line resis. of bars of London dynamo was

$$\frac{106}{4} \times \frac{53.95}{12} \times \frac{8.1132}{339500}$$

$$= .0032 \text{ ohms.}$$

The resis. of the whole as measured was .0049 ohms leaving .0017 ohms resis. for the copper discs.

If decreased in number in the proportion of 53 to 49 and increased in thickness from .102 to .120 the resis. will be

$$.0017 \times \frac{102}{120} \times \frac{49}{53}$$

$$= .001336$$

Total resis. of armature of Central Station dynamo is

.004506

Clarke, Jan. 20/'92 57

Dynamo C No. 4

Each core has 4 layers of No. 10 B.W.G. wire with 364 turns in each layer.

Diam. of wire $\frac{134}{1000}$"

" with insulation $\frac{155}{1000}$"

Diam. of No. 12 B.W.G. $\frac{102}{1000}$"

" with insulation $\frac{130}{1000}$"

With No. 12 9 can get $\frac{155}{130} \times 364 = 434$ turns

Call the resis. with No. 10 as unity – the resis. with No. 12 will be

$$\frac{134^2}{109^2} \times \frac{434}{364} = 1.8$$

With unit of current with No. 10 the magnetizing power is 3·64 and it should be the same with No. 12.

~~364 turns of~~

* It has 434 turns and 1.8 times the resis.

$\frac{364}{434}$ will be the current

and $\frac{364}{434} \times 1.8$ will be the E.M.F. (that for No. 10 being unity)

$= 1.5$.

With the No. 10 - 6 magnets in series - 2 sets in multiple arcs gave sufficient E.M.F.

With No. 12 - 4 in series will be sufficient for E.M.F.

See later page 63

Clarke Jan. 20. 1882

No. 10 wire

364 turns 4 layers

364 × 4 = 1456 total turns.

No. 12 wire

434 turns 3 layers

434 × 3 = 1302 total turns.

No. cir. mils in No. 10 = 18000 approx.

" " " No. 12 = 12000 approx.

Relative Weights

1456 × 3 = 4368

1302 × 2 = 2604

No 12 = 60% No. 10

Chalcocke

Suppose the magnet with No. 10 wire required a unit of E.M.F. to give the necessary magnetizing power, then the magnet with No. 12 wire would require

$$\frac{1456}{1302} \times \frac{1302}{1456} \times \frac{134^2}{109^2} = 1.54$$

In last Dynamo C-No. 3 6 magnets were in series and two sets of these in multiple arc-

With the No. 12 wire $\frac{6}{1.54} = 4$ should be in series with 3 sets in multiple arc.

Clarke —

Machine works wants immediately the size & amount of wire to be put on the new Z machine

Edison

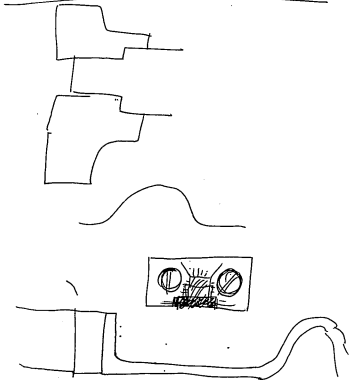
H Ruth

[ITEM FOUND IN BOOK]

THE EDISON ELECTRIC LIGHT CO.
65 & 67 FIFTH AVENUE, NEW YORK.

New York, 188

Length of Field
Fig 1.



[ITEM FOUND IN BOOK]

With one hundred pounds
of copper we have 30 days.

8. 9
64 81

$\frac{50}{1000}$" insulation
$\frac{1}{32}$" between
arm. and ins.

$\frac{1}{8}$" clearance
between wire 1/16"
$\frac{50}{1000}$" paper.

Mark 1/16 clear felt,
bar with $\frac{50}{1000}$" insu
1/16" ins. between iron
and copper discs.
$\frac{1}{32}$" more on each
plate
Mongrel Engine.

[ITEM FOUND IN BOOK]

a 7" Shaft will be strong enough
for that Weight.
Old Pillow Blocks could be used
for 6 7/8" Journal, which
at the rate of 60 ℔ pr. □". should be 15" L.
" " 70 ℔ " " " " 13" L.

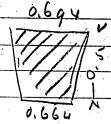
a. 7 1/2" Journal would require
at the rate of 60 ℔ = 12.9" } Length -
" " 65 ℔ = 12"

a. 7 1/2" Journal
at the rate of 60 ℔ - 12." Length -
The Length of Shaft Coupling included
would be for.

Journal	12" long	—	110"
	12.9	—	— 111.8.
	13	—	— 112.
	15	—	— 116.

Rankine allows a pressure
from 50 to 150 ℔ pr. □ in ok.
a - 6 1/8 Journal 12" long will have
to stand 75 ℔ pressure pr. □".

[ITEM FOUND IN BOOK]



53 of this Grid 57.114
52 of this Grid 57.232
1 of this Grid 45.03

$\left(\frac{15}{1000}\right)$

Frank G. Soldan
Aug. 17. 1881.

Menlo Park Notebook #223 [N-81-04-06]

This notebook covers the period April-August 1881. Most of the entries are by Francis Jehl. A few entries are by Edison. All of the material relates to electric light and power. There are notes, calculations, and drawings concerning dynamo experiments and tests, including Edison's notes on commutator brushes for the South American dynamo and Jehl's tests of these brushes, based on Edison's instructions. There are also notes by Jehl on changes made in dynamo design as a result of tests conducted at the Edison Machine Works. Other material relates to tests of meters, conductors, steam engines, and motors. The label on the front cover is marked "Francis Jehl" and "Edison Machine Works N.Y." The book contains 280 numbered pages.

Blank pages not filmed: 30-35, 94-95, 230-231, 256-265.

April 6 1881 1

Mr Krusin brought some wire (which he called Hold Bronze Wire) to be tested for its conductivity.

Diameter of the wire was .051

Length 10.58 ft

Temperature when tested 78.8° F = 26° C

It has been ascertain by good authority that one foot of pure copper wire 1/1000 of an inch in diameter has a resistance of

Annealed " " 9.718

hard drawn " " 9.940

In this case I take the mean 9.829 thus therefore pure copper the same diameter and length as sample

(1) 26 .65

would be

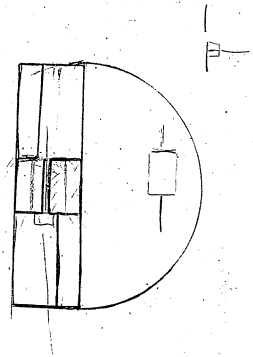
$$\frac{9.829}{51^2} \times 10.58 \times 1.10$$

1.10 is the correction for temperature. Its resistance would be .0 43979 ohms

The sample I had had a resistance of .10914 ohms. Its conducting therefore was .48%.

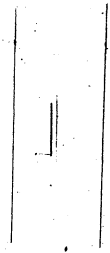
Yours
Jabez

This wire was an alloy of copper ten zinc. It was to be used in connecting mains lines together as the cored be cooled, which pure Cu will not do.



april 31 1860 B

5) 95 ¼
19

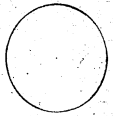


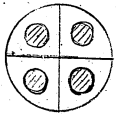
$$443\frac{100}{10000}$$

$$1000\overline{)443000}$$

443

12V





Length of Phos. Bronze wire 16 ft 11 inches

16.11

.050.5 Diameter

959:41 : X : .0187

1049
959

.0187385
959

16864465
93692.5
16864465

41 | 17.97022215 (.437
164
155
123
320
287

(50.5
50.5)
2525
2525
2550.25

9.829.8
16.9
88461
58974
9829
166.1101
1.05
83055.05
16611101
174.41556.05

255025 | 174.4155
153 0150
21400000
20400200

.0038.24
13
11472
3824
1.049712

.0038.24

obtuse.

.068
16
340
68
1.020

.456

.437 | .06809
4 3 9
2430
22
4

Temp 16° C

46

1000
43
954

954 : 46 :: .0187385 : X
46

946/46 = .2187/X

946X .0187385
46
11227310
7495540

954 | .8419710 (.0

46 : 954 :: .0187385

50.5
50.5
2525
2525
255025

9.829
6.6
166.11

.003824
16
22944
3824
1.061184

10/94 .014

.0187385
954
749540
936925
1686465

46 | 17.876529 0 (.388
138
407
368
396
368
28

.388 Res of wire at 16°C

69

166.11
1.06
99666
16611

255025 | 176.0766 (.0689
153015 0

2306160
225
4

176.0766
1.85175

Pure copper = .0690 lbs
angle .386

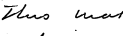
.386) .0690 (.179
386
2020
3096

46
6

5 6

June 20 1881

Dynamo C. (Paris)
Resistance of armature as measured .008 ohms.
Res of each separate core of the magnet 2.7 ohms
There are six of these core thus making 3 magnets complete
There are 13 commutator



copper bars on armature. 1 on figure is .551 ~~tin~~ long. and 2 is .405 wide. the average length of each bar is about 37 inches

The magnet are wound as follows. There are about 18 turns to one foot. length of magnet including the length taken by the wire is 4.66 ft. Thus making on one layer 18 X 4.66 turns. There are 6 layers of wire on each core. The average circumference is 27.5 inches. Diameter of wire is ~~about~~ .134 the regular no 10.

John

23 Jan 11

June 21 1881

We have large casks in which we put some resistance, and put the machine direct on them. The resistance of these are 2.6 ohms these are arranged as follows; 2 so that

When plug 1 is in there is a res of 2.6 ohms.

when plug 1 + 2 is in ares of 1.3, or when plug 1 + 3 is in a res of 1.3 ohms. when plugs 3 + 2 are in a resistance of .65 ohms.

J. E. L.

22 June 29 1881

Test of the resistance of the line consisting of twenty no 10 wire multiple arcs and connected to five calorimeters consisting of about .65 ohms each, with different battery current.

687 : 313 :: x : .0659274 with 1 cell
683 : 307 :: x : .0659274 " " 5 "
& same " " " " 10 "
" " " " 15 "
682 : 318 :: x : .0659274 " 20 "
680 : 320 :: x : .0659274 " 30 "
679 : 321 :: x : .0659274 " 40
678 : 322 :: x : .0659274 " 50
" " " " 60
" " " " 70
" " " " 80
" " " " 90
" " " " 99

.012970 .. 1 cell 23
.012704 .. 5 "
" " 10
" " 15
.012639 " 20
.012509 " 30
.012381 " 40

And also up to 100 cell
it has the same resistance

J. Jahe

682 × .065 = 318 × .065

678 × .065 = 322 × .065 = 3

678 × .065 = 3390 + 4068 = 44.07 ÷ 322 = .13
322
1187
966

July 11 1881

Machine for Paris A Camps

Res of Armature .15 ohms

Res of Magnet 63.5 ohms

size of wire on magnets .55 B & S Gauge

weight on each core is 92.5 lbs

~~that are two layers on one~~

Magnet core and eleven

on the other

July 12 1881

Insulation of a piece of fibre

Def of one cell 255–290

Strength 183000 ohms.

Deflection of all the cell

358 — 361

Deflection of one cell 45–3

$$\begin{array}{r} 45 \\ 3 \\ \hline 2\,|\,75 \end{array}$$

3.7 for 1 cell

$$\begin{array}{r} 358 \\ 361 \\ \hline 2\,|\,719 \end{array}$$

359 fall near the cell

$$37\,)\,3598\ (97$$
$$\underline{333}$$
$$260$$
$$\underline{259}$$

97

$$\begin{array}{r} 285 \\ 290 \\ \hline 2\,|\,5775 \end{array}$$

287

```
      183000
         257
    12810000
   14640000
   36600000
   52521000 constant for 1 cell
          97

   367647000
  472689000
  5,094,537,000 for all cells
```

5'094'537'000

Repair 350

Insulation of fiber over 100000 ohm.

Resistance of Yellow insulation of No. 134 is about 13000 ohms per 13 feet

Insulation, Res. of magnets between wire and iron core

Res. of first 1500
Second 1000
Third 2000

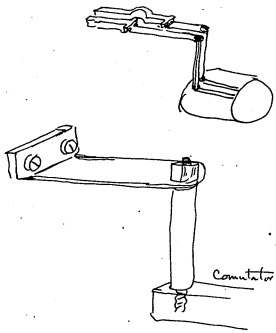
July 14 1881

Resistance of the armature of the C dynamo is .0085 ohms.

After working 55 men days and 60 nights for 8 days and 8 nights we have at last made the change in bars and disk tits which the previous test showed was necessary to make the machine more practical. The narrow tit between which the alternate bars could pass was found to be insufficient and heated the plate thus as shown by the dotted

line, hence it was necessary to make the tit wide, this would then necessitate passing the bars over the tit instead of between this was done as described in some other book. it was a terrible job. we silver soldered the extra piece on the tit but our big press when done will punch

out the plate with its simultaneously
The inside piece from the plate ~~kept~~
leading to the commutator. Kept breaking
and we connected the bars to the bobbin
this.



we japanned the bars - painted them with Zinc white and Linseed oil, then wound tissue paper then repainted. after assembling put mica between all the bars - put the new anti spark device on, The new foundation being done placed Engine on at 11 am. Engine running nicely. taking indication diagrams, for friction, now taking with field on 108 Volts across field armature open (16) Brushes off -

July 15 1881

Dynamo "C"

Deflection on Magnet + armature

Magnets	armature
without any current on magnets	
volts	volts
	14.85 S.350
	15.153. S.351.5
51.97.	108.67 S.350.

Magnet.	armature
Volts	volts Rev 349.5
52.65	103.27 Rev 350.5
56.02	107.37 Rev 350.5
74.35	115.43 Rev 351.5
81.1	124.83 Rev 351
94.5	135. Rev 357
98.5	141.75 Rev. 362.5
97.87	121.5 Rev.
97.87	122.17 Rev. 339
97.87	137. Rev 378

Magnet	Armature	
94.50	138.1	Rev 386
	~~136.22~~	Rev 348.5
91.80	126.22	Rev 346.5
97.20	124.83	Rev 349.
		Rev.
101.25	125.55	Rev 347.5
108.	125.55	343

$\frac{2(81)}{2}$

July 15 / 1881

@ battery was this first load was one which gave a res. of .615 ohms. Dynamo running 335 rev. for one half an hour. When temp of armature was ascertain it was 130° Temp of room 82° running for twenty minutes after this with a resistance of .32 ohms the temperature increased to 142°F. with three barrels on a res of .21 ohms the temperature increased to 163 rising for about 20 minutes.

4 at 86°7

100) 400 (.04
50
2.00

~~150~~

150

$\frac{150}{100} : 100 : \frac{4}{X} : X$

150) 4000 (2.6
2000
1000
900

) 150 (1.5

100) 150 (1.5
100
750

~~150~~) 150 (1.5
100
750
2

July 16 1911

Resistance of water at different Temp. 7° without ~~polarization~~

Six daniells cell used in the bridge

Res 150 ohm at	86°7
" 135 " "	90
" 115 " "	100
" 110 " "	110
105 " "	115

~~This is water clear from sh~~

119	97
110	101
105	108

100) 150 (1.5
100
750
75

July 16 1881

Experiment on two copper balls, one bare and the other japanned to measure their capacity for heat, both being put in ~~hot~~ boil ing water and left to ~~cool~~ cool, their temp being taken every five minutes,

Japanned		Bare	
138	— 1	132	— 1
124	5	124	— 5
113	10	114	— 10
104	15	106	— 15
99	20	101	— 20
		98	— 25

try the experiment with the blower

July 16 1881

Temp 83° F room
Temp of Armature 89° F
Experiment to ascertain the heat obtained by the cutting of the armature core through the magnetic lines of the Dynamo magnet.

time	Temp	
9.38 AM	92	Speed 358 running 10 mn
	93	" 358 " 10
		" 356
	93.5	355.5 Running 30 mn

95 2
95
475 4
855
9025
483 4.16 H.P.
27075
36100
36100

2.16.) 399807.5. (153771
21
139
136
98
78 4
200
182 3
187
187
55

33000) 153771 (4.6
132000
21771.0
19800.0

25

4|.65 2|2.6 3×3
.16 2|1.3 3# 6)9 (1.5
.165

2.6×.16
2.6.+.16

.16
2.6
2.76

.16
2.6
96
32
2.76).416

3
1

276) 310
416 (.15
276
1400
1380
4

5/65
.13

3.

3

.13
2.6
78
26
2.73).338 (.12
273
650
546

2.6
2.73
2.73

.15
.010

70)150 (.4
300
280

.16

95
95
475
855
9025
4413

2
4

75.HP

16 5
144

16) 399807.50 (2498803
324
79
64
157
144
130
128
127
128
0850
48

33000) 2498803 (75.
231000
188803
105800

2

10) 160.
10
150

2

33000) 3163641 (95
297
193
198

15) 105 (7
105

15) 96 (6.4
60
60
0

3

6.4

107
107
749
107
11449
4413
34347
45796
45796

16) 5074192.70 (31513.691
27
16
114
96
59
48
110
96
147
144
30

5

8.57 at 75

25 15
30

.0085

.0085 2
1.065
4 25
5 70
85
.009 0525
1.032

.009
1.032
18
27
.009 288

)92

9) 159 (16) 96
60
54
6

109
109
981
109
11881
443
3 56 43
4 75 24
4 75 24
610

.159
9

33

159) 5 26 32 8.300 (33102400
4 77 ×1 330
1
0493
477
162
159
383
318
650
636
140
4

9) 159 (16
60
54
6

16) 100 (7
96
4

5 | .65
.13

2.6
.13
78
26

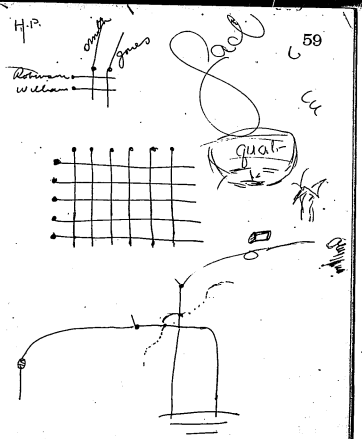
2.6
.13
.39

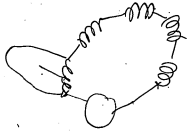
2.6
.13
2.73

273 | .338 (.12
273
650
546

12 | 52 632 8.30 (4386020
48
46
36
103
96
72
72
33
33
0

330 | 4386070 (132. H.P.
33
108
99
96
90
60





July 18, 1881

Temp 79.7° of the bars ~~to~~ before started.

Temp. of Room. 79.7°

July 16 1881

103.95 V without any magnetic circuit. Speed. 1114
100.57 V with one bar across the poles. bars $\boxed{3/4}^2$ Speed 1112
two bars and no difference in the drop.

100.57 V (1090 speed)
95.83 V. with a bar 7/8 by 1 7/8 across the poles.
94.5 with two of these bars, Speed 1160.

Speed 1116. 101.25 volts with out any bars. Speed 1087
95.83 volts with one bar on 7/8 by 7/8 Speed 1107

volts 89.10. Speed 1104.65.
without any bars 102.60 V
Speed 1090

Volts 102.60.
volts 101. with a crowbar.

Got the machine running up to the ~~speed~~ speed and then got the volts which was 102.6 Then put a bar of iron across the poles (bar 7/8 by 1 7/8) and it dropped to 95.8 volts and when another bar was put across it went down to 93.1 volts.

July 19 1881

2 Standard cell equal a deflection of 347-347.

deflection at the terminals of the sounder 72-72.

Deflection from Kick is 51-51

---

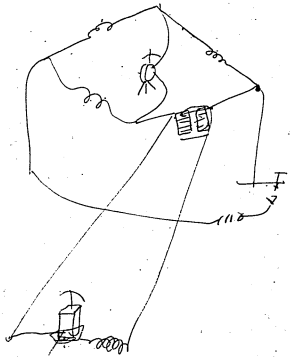
deflection from sounder 54.5-54.5

deflection from Kick 34-34

---

deflection from sounder 70-70

deflection from Kick 50-50



July 19 1881

Deflection on Sounder 70-70
Deflection by Kick 50-50
2 Standard cells = Deflection
347 - 347.

Deflection on Sounder 52
" " by Kick 33-33

Deflection on Sounder 88
" " " by Kick 60) 3 cell

Deflection on Sounder 73
" " " by Kick 41) 2 cell

Deflection on Sounder 54
" " " by Kick 32) 1 cell

Deflection on Sounder 89
" " " by Kick 70

Deflection on Sounder
" " " by Kick.

Test on C dynamo No. 1.

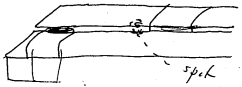
Temp. of air and bars at commencement of experiment 80½° F.

Time. 322 full speed = This test for a few minutes to determine if bearings are all right and she is up to speed, Speed by indicator 355 = no field on - Throttle wide open = We now take friction diagrams — no we had to stop as the iron bands placed around the armature bursted out at the joints and would not hold the copper bars in - We took armature out at 9 pm and started to wind brass wire around it = get this done & armature back in machine at 7 o'clock July 20

OWW

July 20 1881

We run armature little while then put field on but as the field was chaigung up. spitting commenced with loud sound across from bar to bar with 1/32 of an opaci.



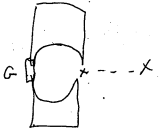
Two spots took place both starting from edge of paper or right near the paper - but across an opace 1/32 inch the spot was small only threw up knobs about 1/32 dia + roughened Edges of bar

over

July 20 1881.

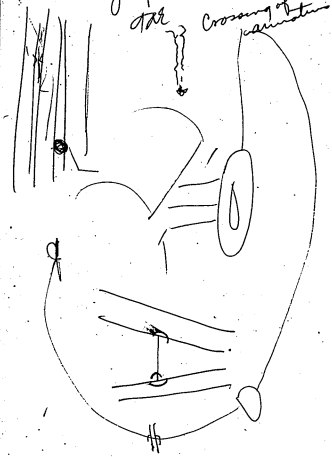
The Commutator brushes were not on Evidently. This spitting is due to E.M.F. accompanied by a Static effect which first starts a static arc and then the other arc commences - & this is the trouble with all dynamos,

One thing is noticable & that is that the "spit" occurs at the moment the bars pass at X & never at G.



July 20 1881.

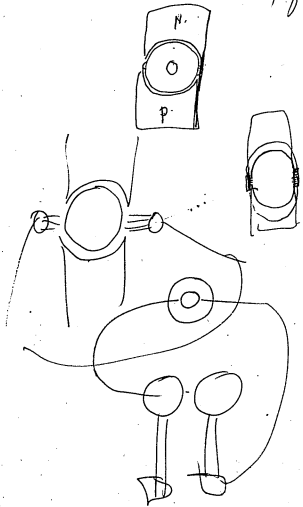
TAR Crossing of annulus

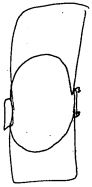


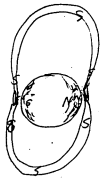
July 20 1881

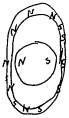
TAR

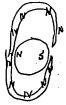
Crossing of annulus





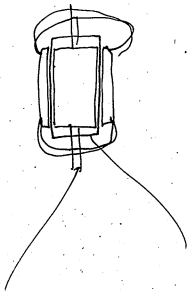


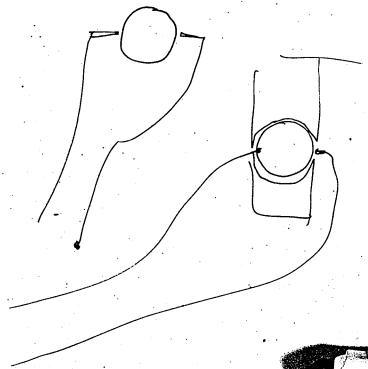




July 20 1881

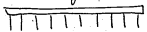
Test the kick between the insulated armature and the field magnet when the field is put on





July 21 1881

We made an arrangement shown in Fig 1



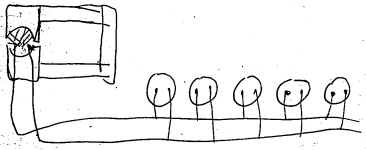
This was held in front of the armature to see if we could collect any electricity, we held it by an insulated handle but did not get any sign of electricity. also tried an paper electroscope without any effect.

July 21 1881

Machine running 323
The field charged by the small machine. We put a sounder with resistance across the line to see if there was any cross: tried it with field and without it, did not find any cross the sounder was steady.
Then we put the cables on the barrels, which were all disconnected.

In front of the poles on the wheel was a large metal plate of brass connecting the poles

Now when the armature was connected to the ~~ga~~ cables which went into the testing room where they were attatched to the resistance coils as show below



The plugs to the resistance coils were disconnected the water being the only conductor across (The resistance of this water is About 3 ohms) Now when the engine was running at 333 Rev and the mag net was charge from this

small machine, when there appeared a large flash at the armature. This spark only appeared when the cables was on, we having tried it before without any cable and it worked all right.

We then took a resistance box out of a barrel and put the the machine on, this coil was so arranged so that it have a resistance of 2.6 ohms and when the machine was put on this it went ok. not giving any spark. then we connected the one side of the four barrels and

did not get any spark.
The other sides were also then connected and we ran about 10 minutes and did not get any spark, then we connected all the other barrels (lower in connecting) short circuited the wires and Mr Edison found that it (the armature) was crossed in three places)

The Engine was run'd again on ~~seven~~ six barrels the plugs all out. The spark came again.

I then put one resistance in so that it was .65 ohms and immediately the machine sparked.

did not get any spark
then the other sides was
connected in

15) .0085 (.00
.2

15) 85 (5 8 .00056
75
108
.00

15) .008 (.000

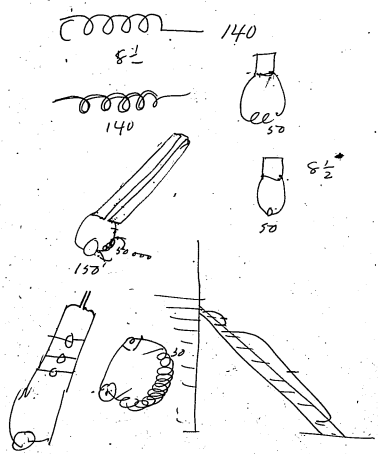
ε

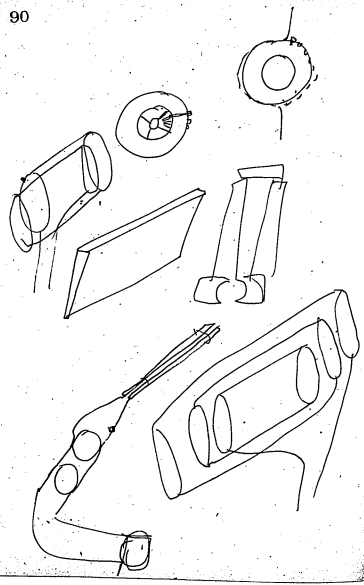
$e = \frac{\varepsilon}{R}$

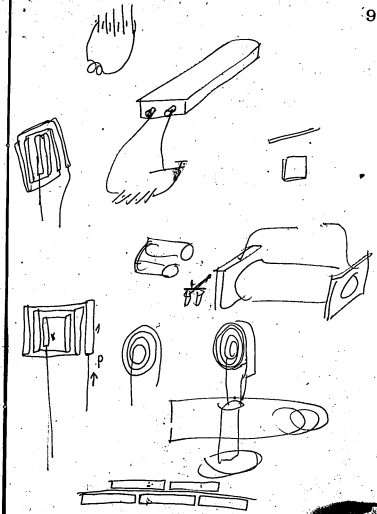
$eR = \varepsilon$

$R = \frac{\varepsilon}{e}$

.00056
.0085
.00906



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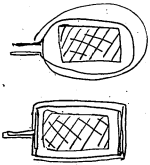

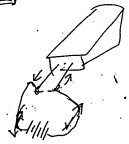

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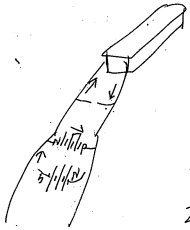

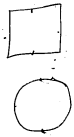

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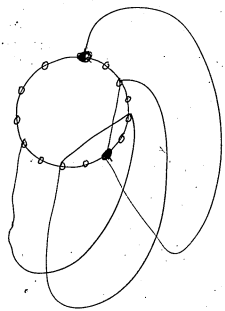
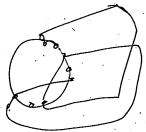
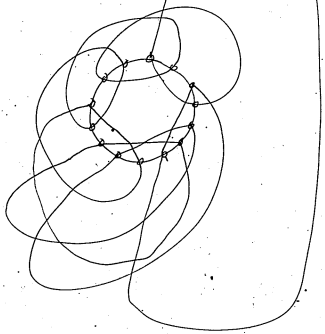
July 22 188





July 22 1881



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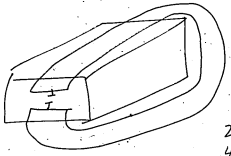

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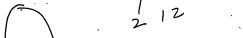

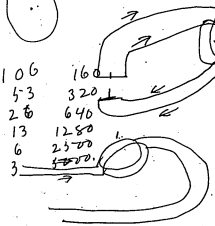

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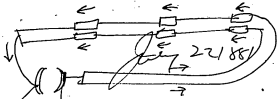
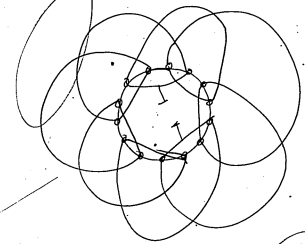
July 22 1881





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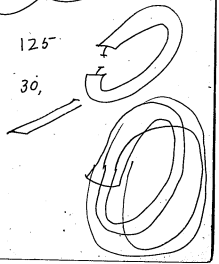
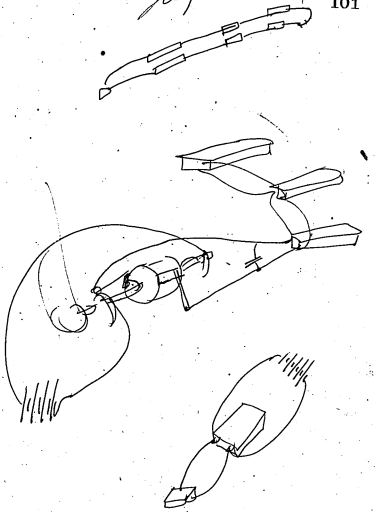
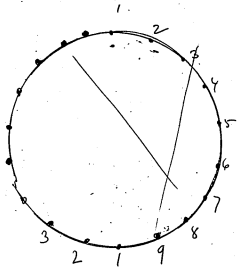


July 22 / 1887



July 22 1881



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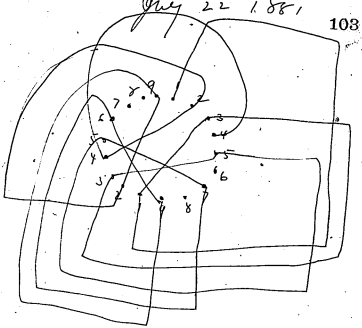

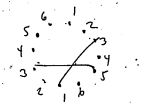

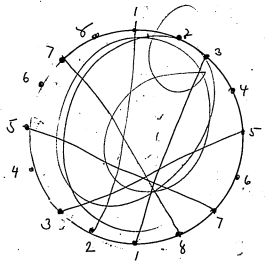

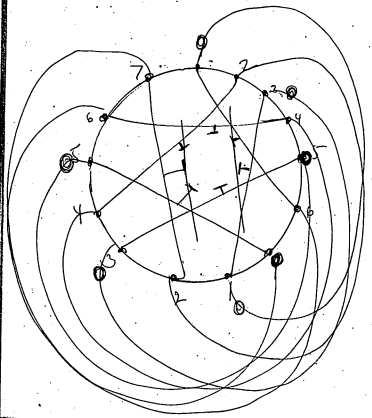

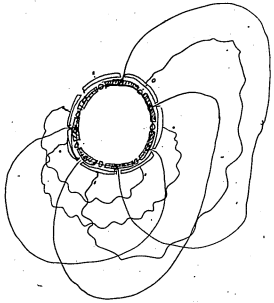

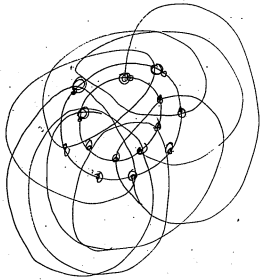

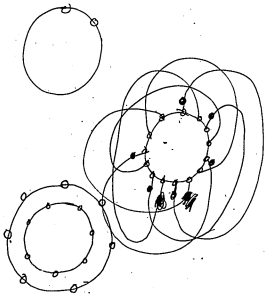

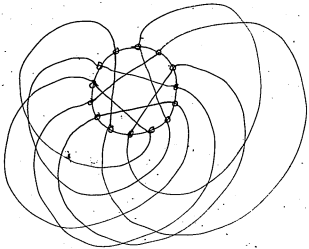

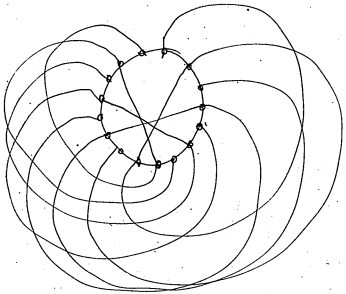

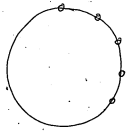

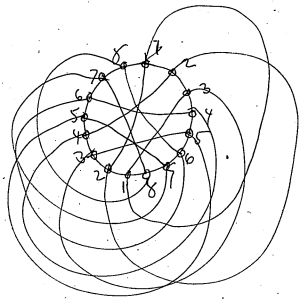

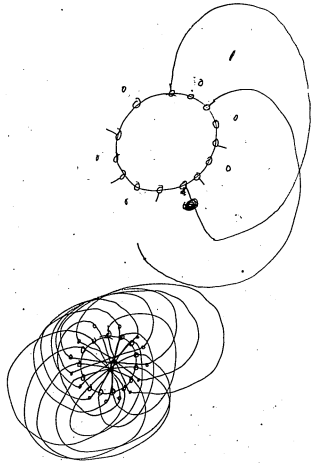

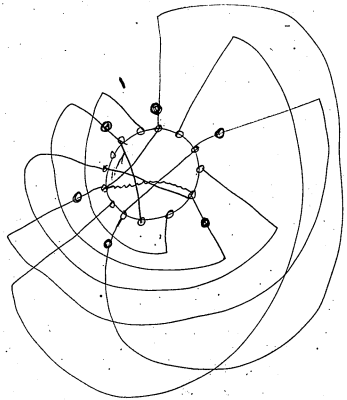

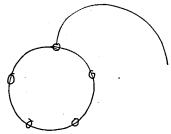

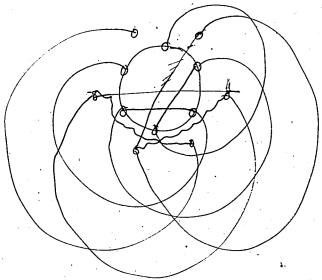

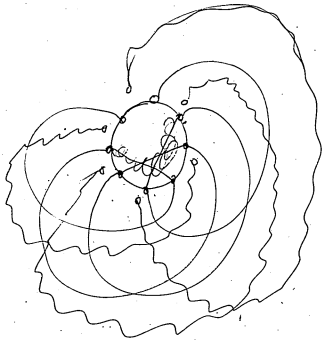

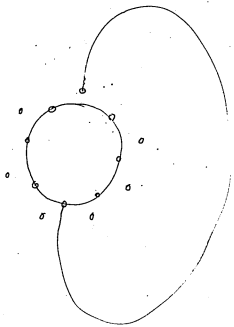

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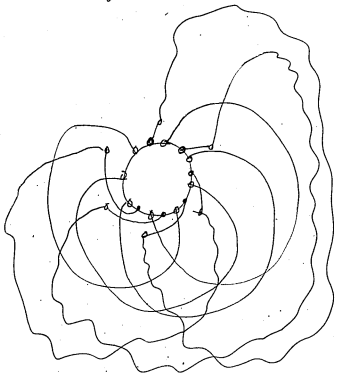

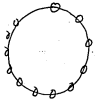

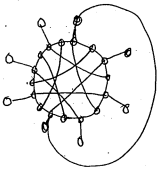

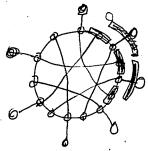

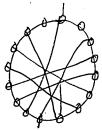

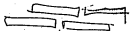

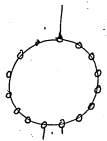

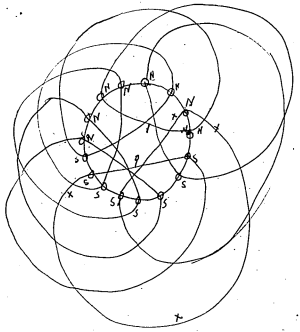

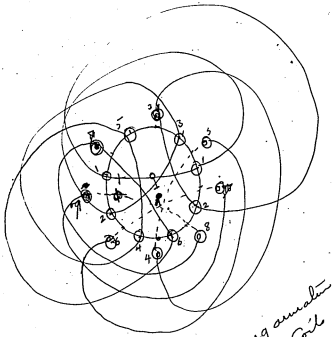

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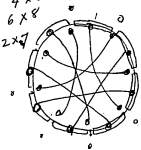
TAB Ok winding around with the alternate Coils over the other make up EMF small

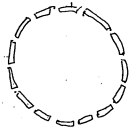
1 × 7
1 × 5⁻
3 × 3
5⁻ × 7
1 × 7
2 × 6
4 × 4
6 × 8
2 × 7

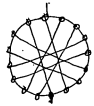
1 3 5⁻ 1

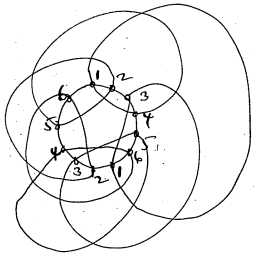
1
3
5⁻
1
2
4
6
2



Ok



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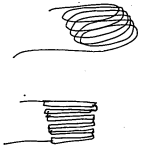
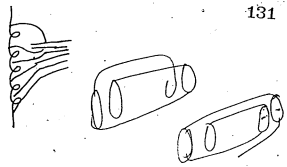
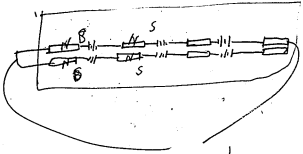
5
6



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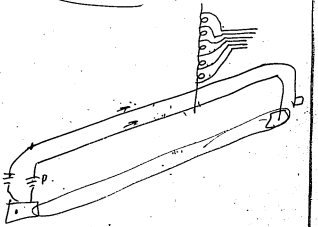
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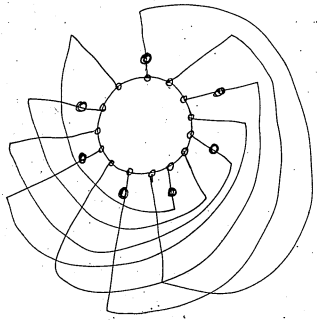
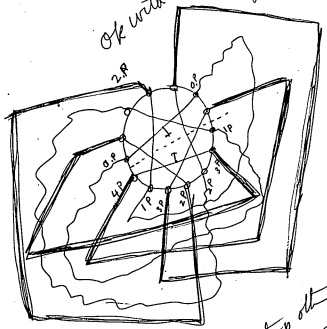
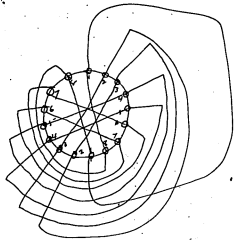
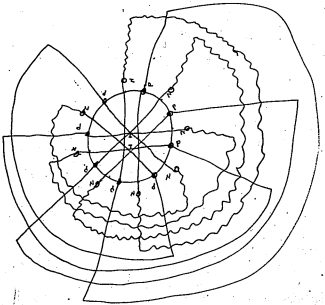


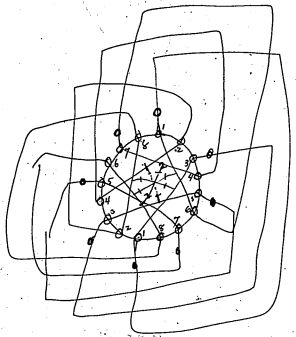
OK with odd no of coils

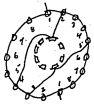


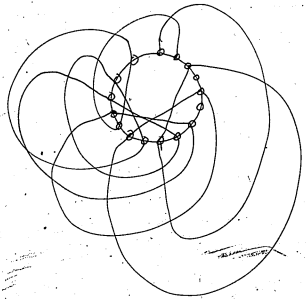
Wound on top of
July 25 1881
TAE

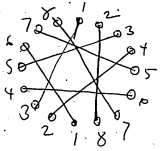


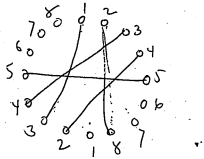


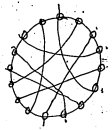


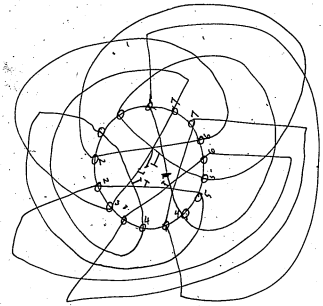




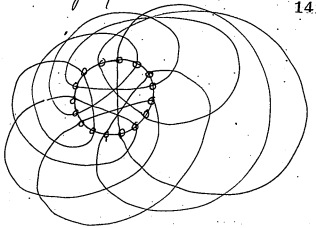


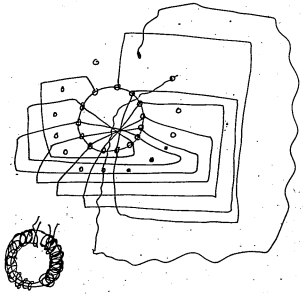


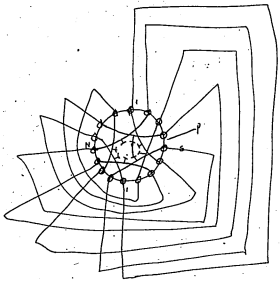


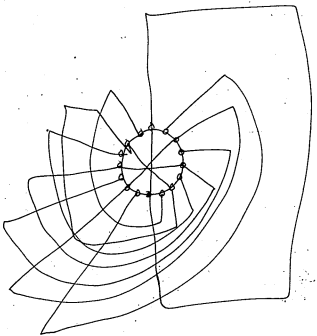


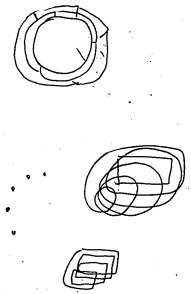
July 22/85.

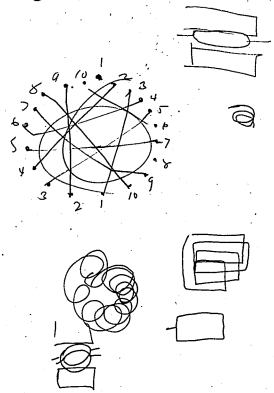











1
2
3
4
5
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9
10
1
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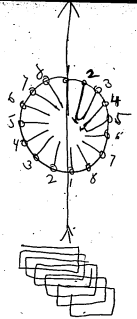
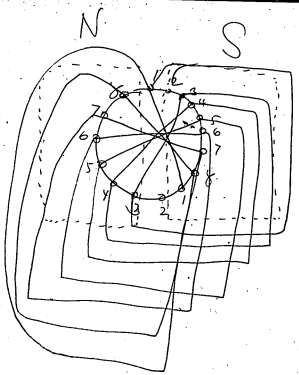
10

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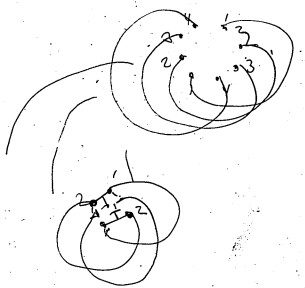
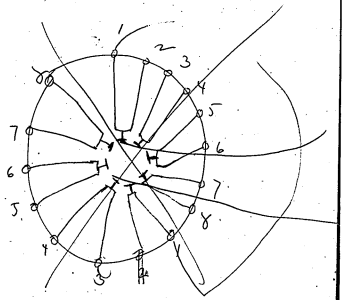
July 22 1881





July 26 347 div on one elec through 10000 ohms.

deflection with x res = 21 − 21 351

deflection through 10000 ohms. 347 − 351

deflection with x res 15 elec − 321 − 324

July 26

347
351
2 | 6 7 8
349 maximum div
10000 ohms

21 | 3 4 9 0 0 0 0 (166,190. ohms
21 * * * * *
139
126
130
126
40
21
190
189
10
322

349 0 0 0 0
15
17 4 5 0 0 0 0
3 4 9 0 0 0 0

24
21
2 | 6 5
27

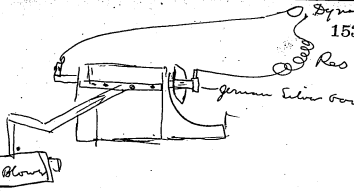
322) 5 2 3 5 0 0 0 0 (16457
3 2 2 * * * * *
2015
1932
830
684
1 8 4 0
1 6 1 0
2 5 0 0
2 2 5 4
2 4 6

6190
2.77
3-13

July 27 1881 7/16

Went to Bergman and had a piece of German Silver strip .0065 of an inch thick, and about 25/16 wide. Had this piece which was about 3 ft long made into a square bar the like this

I then connected this with the small dynamo machine with 2.6 ohms in circuit. And it heated it up to 195°7. I then had the experiment tried as shown in the fig on the next page



~~Temp~~	~~Time~~
~~beginning 195°7~~	~~first minute~~

Temp. beginning	~~1 minute~~			
205	~~2~~	205	143°	~~15~~
	10 Second	190°	146	15"
	20 "	175°	152	30"
	1 Minute	155	156	45"
	2 Minutes	144	162	1'
	3 "	188	168	1.15"
	4 "	" "	171	1.30"
			174	1.45"
			178	2'

Temp. °F.	Time
181	2.15"
182	2.30"
185	2.45"
187	3.
189	3.15"
190	3.30"
191	3.45"
194	4.
195	4.15"
196	4.30"
198	4.45"
199	5.
200	5.15"
201	5.30"
202	5.45"
203	6.

Temp. °F.	Time
203	6.15"
204	6.30"
204	6.45
205	7.
206	7.15"
206	7.30"
207	7.45"
208	8"
209	8.15"
209	8.30"
210	8.45"
210	9.
211	9.15"
211	9.30"
212	9.45

Temp	Time
212 F.	10"
212	10'.15"
212	10.30"
212	10.45"
213	11'
213	11.15"
213	11.30"
213	11.45
214	12"
214	12'.15"
214	12".30
214	12.45
215	13"
215	13'.15"
215	13'.30"
215	13'.45"
216	14"
216	14.15

Temp	Time
216	14.30
216	14.45
216	15.
217	15.15
217	15.30
217	15.45
217	16.
217	16.15
217	16.30"
218	16.45"
218	17."

~~Temp~~ to	
216	10.
211.	20
205	30
201	40
196	50
191	60
187	70
184	20
181	30

here we put the blast on again and took the temp every 10 seconds.

Temp F°	Time	Seconds
179	40	
177	50	
174	60	2
170	10	
169	20	
167	30	
166	40	
165	50	
164	60	3
164	10	
163	20	
162	30	
161	40	
160	50	
159	60	4
158	10	
158	20	
157	30	
156	40	
155	50	
155	60	5

Temp	Time	Seconds	Temp F°	Time in Seconds
155	10		146	10
154	20		146	20
153	30		146	30
151	40		146	40
151	50		146	50
151	60	6	146	60 10
151	10			
151	20			
150	30			
150	40			
150	50			
150	60	7		
149	10			
149	20			
149	30			
148	40			
148	50			
148	60	8		
148	10			
147	20			
147	30			
147	40			
147	50			
146	60	9		

Here I took this bar of German Silver and covered it with 8 thickness of the parchment paper was area that present or permitting to this experiment the heat only struck No. on one side of the bar.

~~Time in Seconds Temp in °F~~

Temp. beginning 210

Time	Temp	Time	Temp
10	207	10	159
20	203	20	158
30	199	30	157
40	195	40	155
50	190	50	154
60 — 1′	186	60 — 4′	154
10	183	10	153
20	179	20	152
30	176	30	152
40	174	40	151
50	172	50	150
60 — 2′	170	60 — 5	150
10	168	10	150
20	166	20	149
30	164	30	148
40	163	40	148
50	161	50	148
60 — 3	160	60 — 6	147

Time	Temp
10	147
20	147
30	146
40	146
50	146
60 — 7	146
10	146
20	145
30	145
40	145
50	145
60 — 8	144
10	144
20	144
30	144
40	144
50	144
60 — 9	144
10	144
20	144
30	144
40	144
50	144
60 — 10	140

Then we tried the bars so that a circulation of air could be passed around it. There was an air space of about 1/32 of an inch.

Temp beginning 200

Time in Seconds

Time	Temp
10	191
20	184
30	172
40	162
50	152
60	147
1 10	142
20	137
30	132
40	128
50	126
60 2	123
10	118
20	108
30	108
40	108

Time	Temp
50	104
60 3	102
10	100
20	
30	
40	
50	
60 4	
10	
20	
30	
40	
50	
60 5	

Time	Temp
	205
10	197
20	187
30	179
40	169
50	160
60 6	154
10	147
20	143
30	138
40	136
50	132
60 7	129
10	125
20	124
30	122
40	120
50	120
60 8	118
10	117
20	116
30	
40	
50	
60 9	
10	
20	
30	
40	
50	
60 10	109

July 29 1881

Quick Motor test

Resistance of the magnet = 3.55 ohms

Armature Res = 4.75 ohms

4|321
80

80 times

10000
60 0000
80

7|480,000,000

10000
60 000000
80

7|480,000,000
60 6.8 0000

3/8

57
8
2|20
60

327
321
2683
4|321.5
8

5.8
12|70
60
186
1

Aug 1 1881

Test of the insulation of Mr Kneen. Tubes

~~Ref from all the cells 303-39~~
~~One cell~~

Deflection from all cells. 322 — 321
" " one " 3 — 5

Ref of one cell through 10000 ohms. 59 — 61

Deflection through the tube with all the cells. 5 — 9

1 5 — 9
2 4 — 8
3 4 — 8
4 8 — 7
5 3 — 7
6 3 — 7

339 through 100000 ohms

1 cell = 342

100000
340
400 0000 3
300 00
3400000 00
70 | 27 2000000
40

70
35
2|105
50

500 | 272 000 000
544 0000 22

5 | 272 000 000
5,440000

5,440 000

1 cell = 356 — 355 difference
2 cells = 7—8
1 cell = 3—4

1 cell through 183 000 ohms
= 243 — 220

4

One cell through 183000

230 — 229

---

20 cell 9,15

224

12

183000

230

5499000

3660000

42090000

20

12) 541,800000 (70,150,000

54

18

00

00

0

Aug 2 1881

time 2 AM.

Measured the Paris Machine. its resistance was .0092 ohms.

The bars of the machine as now arranged consists of first, in the bars being japanned ~~to~~ five times and then wound with two layers of the special parchment paper and this being japanned also.

The machine was started at about 6.30 am. Aug 2 1881.)

The ran 304 Revolutions and gave 92 volts with 1 barrel or .65 ohm in circuit which is equal to about 200 lamps with the present resistance of 125 ohms.

Then with 322 Revolutions we got 96 volts, still .65 ohm in circuit.

335 Revolutions 99 volts
342 Revolutions 101 volts
346 Revolutions 103 volts
350 Revolutions 105 volts

350 Revolutions 97 volts this time 2 barrels which is equal to about 375 lamps.

350 Revolutions 92 volts with 3 barrels which is equal to about 625 lamps

And with 4 barrels the electromotive went down to 87 volts, the 4 barrels equal to about 800 lamps.

All these trials so far were ~~w~~ made without that extra magnet

With that extra magnet added the electromotive went up to 95 volts with 388 Revolutions. With this load on of the four barrels it ran for 25 minutes, then we stopped to put another bar around the armature.

Aug 2 1881

Res of Small motor Mag. 388 ohm
Armature Res 4.7 ohms

Revolutions 1280

with no current on the magnets
Residual magnetism deflect from armature 98 – 97
Standard cell 20 def = 298 – 299

Armature deflection 146 – 138 10.05
Standard cells 298 – 299

Magnet 94 – 101 6.9 volts
Standard cells 298 – 299

Magnet = 199 – 192 14 volts
Standard cell = 298 – 299
Armature = 190 – 185 13.6
Standard cell = 298 – 299

Revolutions 1190

Armature 243 – 245 17.5 volts
Standard cells 298 – 299
Magnet 262 – 255 18.75 Volts
Standard cell 298 – 299

Revolutions 1160

Magnet 350 – 345 23.75
Standard cell 298 – 299
Armature 337 – 338 24.15
Standard cells 298 – 299

Revolutions 1268

Armature 333. 330 33.00
Standard cells 212 – 212
Magnets 340 – 334 34.45
Standard cells 212 – 212

Revolutions 1290

Magnets 286 – 289 34.85
Standard cells 154 – 153
Armature 250 – 268 34.7
Standard cell 154 – 153

Revolutions 1298

Armature 305 – 305 43.2 volts
Standard cells 154 – 153
Magnets 309 – 315 43.8 Volts
Standard 154 – 153

Revolutions 1260

Magnets 270 – 270 54.5 Volts
Standard cells 109 – 108
Armature 236 – 236 45.80
Standard cells 109 – 108

Revolutions 1281

Armature 272 – 276 54.6 Volts
Standard cells 109 – 108
Magnets 347 – 339 66.95
Standard cells 109 – 108

Revolutions 1279

Magnets 274 – 275 54.4
Standard cells 109 – 108
Armature 210 – 212 41.9
Standard cells 109 – 108

Revolutions 1219

Armature 205 — 204 40.1
Standard cells 109 — 108
Magnets 216 — 213 88.4
Standard cells 109 — 108

Revolutions 1205

Magnets 224 — 224 108.8
Standard cells 49 — 45 60.4
Armature 188 — 188
Standard cells 49 — 45

Revolutions

Armature
Standard cells
Magnets
Standard cells

49
45
294
47) 132 (2.8
94
380
6
2

21.6
2.8
1728
432
6048

47) 225 (4
141
2

5 47) 225 (4.8
188
370
376
4

21.6
4.8
1728
864
10368 volts.

21.6
4.8
1728
864
14368 volts

Aug 2 1881

Dist Cell "C" Dynamo

Armature Res .0092 magnets 19.3Ω

Started 11.45 P.M.

Residual magnetism

Deflection on armature.

Rev. 343

Fallows 32 32

Machine 6 – 6 4 volts

Diagram no 1

Rev 350

Armature 136 – 135 9.28V

Standard 314 – 311

Magnet 35 – 35 2.3V

Standard 311 – 314

diag no 2

Magnet 81 – 81 5.6V

Standard 311 – 314 no 3 diag

armature 341 – 346 23.7V

Standard 311 – 314

Rev 348

Arm 244 – 239 41.5V 179

Standard 108 – 109

Mag 59 – 57 11.4V

Standard 108 – 109

Rev 350

Diag no 4 3 lap on th

Diag no 5 put the lap off

Mag 81 – 77 15.7V

Stand 108 – 109

Arm 296 – 291 58.3V

Stand 108 – 109

Rev. 348

Diag no 6

Arm 320 – 328 64.8V

Stand 108 – 109

Mag 92 – 93 18.3V

Stand 108 – 109

Rev 352

Diag no 7

Mag 103 – 101 20.3 V
Stand 108 – 109
Arm 340 – 335 66.9 V
Stand 108 – 109
Rev 346

Diag no 8

Arm 206 – 209 71.2
Stand 62 – 63
Mag 65 – 65 21.6 V
Stand 62 – 62
Rev 350

no 9

Mag 72 – 73 23.1 V
Stand 62 – 63
Arm 216 – 219 75.6 V
Stand 62 – 63
Rev 350

no 10

Arm 225 229 77.7 V
Stand 62 – 63
Mag 81 – 79 28.1 V
Stand 62 – 63
Rev. 350

no 11

Mag 88 – 85 30.2 V
Stand 62 – 63
Arm 241 – 238 82.2 V
Stand 62 – 63
Rev. 349

no 12

Arm 250 – 255 86.4 V
Stand 62 – 63
Mag 96 – 100 – 32.4 V
Stand 62 – 63
Rev 351

No 13 43.2V

Mag ~~[illegible]~~ ~~[illegible]~~ 121 – 124
Stand ~~[illegible]~~ – ~~[illegible]~~ 62 – 63
Arm 270 – 275 95.V
Stand 62 – 63
Rev 351 –

No 14

Mag 156 – 160 54.V
Standard 62 – 63
Armature 290 – 294 99.3V
Stand 62 – 63
Rev 350

No 15

Arm 291 – 292 101.5V
Stand 62 – 63
Mag 195 – 191 66.9V
Stand 62 – 63
Rev 351

No 16 183

Mag 210 – 214 73.4V
Stand 62 – 63
Arm 296 – 304 103.6V
Stand 62 – 63
Rev 349

No 17

Arm 310 – 301 105.8V
Stand 62 – 63
Mag 240 – 242 84.2V
Stand 62 – 63
Rev 350

No 18

Mag 264 – 258 90.7V
Stand 62 – 63
Arm 315 – 306 108.V
Stand 62 – 63
Rev 349

No 19

Arm 310 – 319 108.5 V
Stand 62 – 63
Mag 289 – 297 101.5 V
Stand 62 – 63
Rev 351

No 20

Mag 290 – 283 99.35
Stand 62 – 63
Arm ~~62 – 6~~ 318 – 307
Stand 62 – 63
Rev ~~344~~ 350

No 21

Arm 314 – 321 110.1 V
~~Stand~~ 62 – 63
Mag 333 – 336
Stand 62 – 63 116.6 V
Rev 348
Stop 2.10 am Aug 3 1881

$\frac{10}{14}$
$\frac{29}{}$

$62)\frac{314}{\frac{310}{4}}$ (5.

$\frac{21.63}{10.50}$

with extra magnets on
the deflection was 214-214
Standard balls 46-49

Started at

This is with four bands
Magnet 207 - 207
St. balls 46 - 49
Armature. 87 - 85
St balls 46 - 49
Rev ~~[illegible]~~ 120 1 minute

Magnet
Standard Constant as above
Armature 70 - 67
Standard 46 - 49
Rev 104

Armature 68 - 70
Standard 46 - 49
Rev 96

Armature 56 - 53
Standard 46 - 49
Rev 88

Armature 86 - 84
Standard 46 - 49
Rev ~~[illegible]~~ 136

Armature 104 - 100
Standard 46 - 49
Rev 140

Armature 101 – 104
Standard 46 – 49 47
Rev. 146

Armature 105 – 102 47.5
Standard 46 – 49
Rev 148

Armature 102 – 105 47.5
Standard 46 – 49
Rev 150

Armature 134 – 131 60.5
Standard 46 – 49
Rev 200

Armature 120 – 121 54.5
Standard 46 – 49
Rev 196

Armature 136 – 133
Standard 46 – 49
Rev 198

2 below each line is wrong

Armature 131 – 134 60.4
Standard 46 – 49
Rev 200

Armature 134 – 131 60.45
Standard 46 – 49
Rev 200

Armature 150 – 147 66.95
Standard 46 – 49
Rev 216

Armature 151 – 154 69.5
Standard 46 – 49
Rev 224

Armature 155 – 152
Standard 46 – 49 6.9
Rev 222

Armature 159 – 162
Standard 46 – 49 13.4
Rev 240

Armature 159 – 162
Standard 46 – 49 13.4
Rev 232

Armature 159 – 162
Standard 46 – 49 13.4
Rev 232

Armature 165 – 162
Standard 46 – 49 15
Rev 242

Armature 162 – 165
Standard 46 – 49 15
Rev 243

Armature 166 – 165
Standard 46 – 49 15.6
Rev 248

Armature 175 – 178
Standard 46 – 49 19.9
Rev 265

Armature 178 – 175
Standard 46 – 49 8.25
Rev 266

Armature 176 – 179
Standard 46 – 49 8.25
Rev 268

Armature 180 – 189
Standard 46 – 49 16.4
Rev 268

Armature 191-194
Standard 46-49 88.5V
Rev 298

Armature 196-193
Standard 46-49 88.8V
Rev 301

Armature 205-202
Standard 46-49
Rev 322 92.8V

Armature 204-207
Standard 46-49 95V
Rev 320

Armature 208-206
Standard 46-49 95V
Rev 323

Armature 210-213
Standard 46-49 97V
Rev

Armature 214-211
Standard 46-49 97.5V
Rev 330

Armature 214-211
Standard 46-49 97 Volts
Rev 327

Armature 215-212
Standard 46-49
Rev 330

Armature
Standard
Rev

Armature
Standard
Rev

J.J.

Aug 4 1881

Started at 2.26 am.
Load four barrels.
Rw ~~335~~ 334 95 volts

2.6

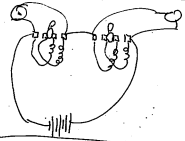
900 | 13500 (138
35 00
27
8200

2.6 : x : 13291 : 28134
x
253
26
1698
566
329 | 7355.8 (2.23
658
778
658
1200

2 | 2.23
2 | 1.11
.55

4 | .55
.13
30
4 | .55
.1375

Aug 4, 1881 Test of the Rec of a resistance in water and out of it with a dynamo current



2.24 ohm

Temp of water 97.7
Temp of room 83

Deflection on outside coil 328 330
" " inside " 280 277

~~deflection cask~~
~~" " outside~~

Cask			Outside		
282	284	286	329	321	325
283	284	275	329	328	314
283	281	266			305
283	281	261	329	326	300
284	281		329	326	301
284	285		329	325	
	282		329	311	

66.5
66.5
13.0

Where Q is all on the out side 7.
three

Defection
Outside 284

Inside
Def.

Inside	outside
269	310
269	312
272	314
269	314
	209

Meter Test Aug 5 1 to

screw plate Monthly weight	without screw weight
78103½	67695
76456.45	69368.5

a gain of 1673.5 mg of copper
15 lamp burning 33 hrs
1 lamp burning 33 hrs will deport
111.5 mg of ~~cop~~ copper for 1 hr 1 lamp will deport 3.380 mg.

70929	71312
70902.3	71376.6

yesterday call for 1 lamp burning 33 hr will gain 4.30 mg and for 1 hour it will deport .13 mg

Aug 5, 187 Paris tests

~~Wheel without any current on the magnet~~

~~deflection on~~

~~arm 266 – 283~~

~~St. B. 297, 295.~~

~~Tin 1~~

~~Rev 353~~

~~arm 293 – 295~~

~~St. B 297 – 295~~

~~Mag 37 – 39~~

~~S.B. 297 – 295~~

~~Rev~~

~~without an c on mag~~

~~arm 212 – 231~~

~~S.B. 297 – 295~~

~~Stin lbo 124~~

~~Rev~~

mag with C on mag.

S.B.

arm 206 – 202

SB 297 – 295

Rev 349

dia 1

mag

Mag 38 – 40

S.B 297 – 295

arm 243 – 246

S.B 297 – 295

Rev 350

dia 2

---

mag 80 – 77

S.B 297 – 295

arm 334 – 331

S.B 297 – 295

Rev 343

dia 8

---

4 lamp battery 40 ohm

mag 76 – 73

S.B 195 – 197

arm 276 – 283

S.B 195 – 197

Rev 350

dia 4

Mag 97-99
S.B 195-197
arm 225-227
S.B. 121-124
Rev 352
dia 5

Mag 74-77
S.B 121-124
arm 246-266
S.B 121-124
Rev 350
dia 6

Mag 91-88
S.B 121-124
arm 301-300
S.B 121-124
Rev ~~7~~ 349
dia 7

Mag 100 102
S.B 121-124
arm 321-325
S.B 121-124
Rev 349
dia 8

Mag 116-114
S.B 121-124
arm 276-275
S.B 94-92
Rev 350
dia 9

---

arm 285-287
S.B. 94-92
Mag 99-98
S.B 94-92
Rev 351
dia 10

Mag 108-109
S.B. 94-96
arm 309-309
S.B 94-92
Rev 351
dia 11

Mag
S.B
arm
S.B
Rev
dia 12

Mag 115-110
S.B. 94-92
am 320-321
S.B. 94-92
Rev 350
dia 12

Mag 130-132
S.B. 94-92
am ~~130~~ 345-349
S.B. 94-92
Rev 348
dia 13

Mag 95-96
S.B 63-62
am 250-245
S.B 63-62
Rev 350
dia 14

Mag 104-96
S.B 63-62
am 251-249
S.B 63-62
Rev 349
dia 15

Mag 113-122
S.B 63-62
am 268-275
S.B 63-62
Rev 348
dia 16

Mag 136-126
S.B 63-62
am 281-282
S.B 63-63
Rev 351
dia 17

Mag 140-148
S.B 63-62
am 292-294
S.B 63-62
Rev 350
dia 18

May 183-176
SB 63-62
Ann 318-316
SB. 63-62
Rev 350
dia 19

May 196-203
SB 63-62
Ann 324-324
SB 63-62
Rev 351
dia 20

May 224,217
SB 63-62
Ann 253-248
SB. 51-44
Rev 349
dia 21

May 186 180
SB 51-44
Ann 259 254
SB 51-44
Rev 350
dia 22

May 200-215
SB 51-44
Ann 262-265
SB 51-44
Rev 351
dia 23

Aug. 6 1881

Experiment to determine the amount of foot lbs require to heat a given surface to a given temperature.

J. J.

Amount of surface on the strip which was of german silver. 18 3/8" long 2" wide

18 3/8 = 18.37 this × by 2 = A which is 36.74 sq. inches.

This × by 2 = 73.48 sq. inch of surface on the whole strip.

1 Experiment.

Temp of Room 85°F

E.M.F. at the two ends of the strip = .197457 volts.

Temp of the strip when raised to this temp 103°F.

Res. of strip .008 ohms at about 85°F.

2d Experiment

EMF on the two ends of the strip .175577 volts

Res of Strip .008 ohms

Temp of Room 86°F

Temp of Strip 99°F.

3d Experiment

E.M.F. between the ends is .130559 volts.

Res of strip .008 ohms

Temp of Room 86°F.

Temp of Strip 94°F.

Sq. Mil contains 27 878 400 sq feet

1. Experiment.

$(.197)^2 = .038809 \times 44.3 =$

$1.719387 \div .008 =$

218.9 ft lbs required to raise 73.48 sq inches to a temp of 103.7°.

~~73.48 ÷~~ $218.9 \div 73.48 = 2.8$ ft lbs on square inch.

Now 100 H.P. has 33000000 foot lbs.

~~28~~ $33000000 \div 2.8 =$

1178571 square inches

$1178571 \div 144 = 8184$ this ÷ by 2 = 4092 square required.

2. Experiment

$(.175)^2 = .030625 \times 44.3 =$

$1.356875 \div .008 = 169.6$ ft lbs for a area of 73.48 sq inches. Making 2.3 f. lbs to one square inch of surface to put it to a temp of 99°f room being 86°f

100 H.P. has 33000000 ft lbs

$33000000 \div 2.3 = 14478260$ sq in

$14478260 \div 144 = 100540$ sq ft

$100540 \div 2 = 50270$ square feet required.

3d Experiment

$\therefore (130)^2 = .0169 \times 4413 =$

$.74867 \div 1.008 = 93.5$ ft lbs

required to heat 73.48 sq inches

to a temp of 94°7

Room being 86°7 or

1.2 ft for each square

inch surface

~~100 H.P. has 3300000 ft lbs~~

$3300000 \div 1.2 = 2750000$

$2750000 \div 144 = 19097$ sq ft

$19097 \div 2 = 9528$ sq feet

required

115
115
575
115
115
13225
44
52900
52900
581900

158 / 581.900.000 (3.6820 11
474
1079
948
1310
1264
460
316
1440
1422
180
158
220
158

158.

8
16
128

158
15
0

850
16
0
0
5100
850
1360

850
15
4250
850
12750

850 / 15800 (1
850
3080

850 / 15800 (8.
850
7380
6800
5000.

18 / 111 (6.
108.
6. hp.

33 / 368.2911 (111 1/2
33
38
33
52
33
19.

850
20
17000

14 / 368.2911

850
18
6800
850
15300

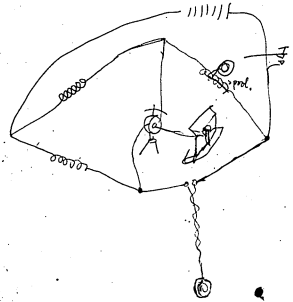
850
15
7650
850 / 161.50

161.

18 to 1.

66.
5.

1
0.83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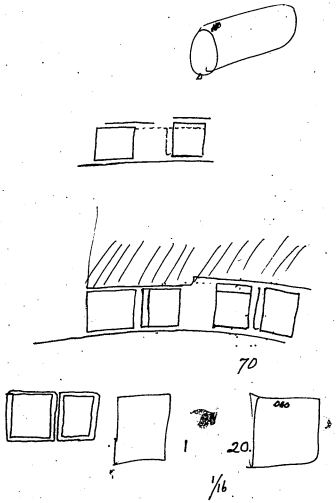
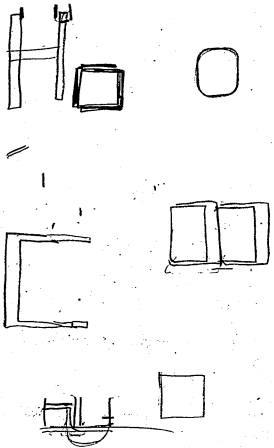
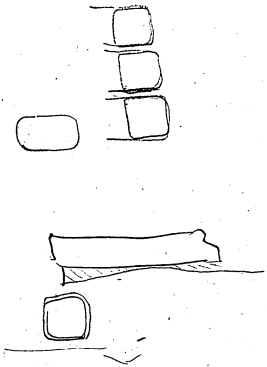

70
1
20.
1/16





Aug 5 1857 ~~Temp of Room 95~~

Dead of Paris dynamo

Volts 95 Circuit 4

Started 330 Rev at 1 PM

Stopped running at 1.15

Temp of Arm.

Started 1.55 Rev. 330

runned 9 minutes

Started 4.34

Ran 11 MM. Temp about 125

~~Started again at 4.47 P.M.~~

The dynamo ~~to~~ ran 20 minutes with four barrels on

~~Started again at 7.37~~

Aug. 7 185

~~Stroke 11.20 Arm~~

without any Cor

the magnet

Armature magnetism

def in arm 52–49

S.B 301–302

Rev 348

Mag 23–24

S.B. 252–255

Arm 244–242

S.B. 252–255

Rev 348

Mag 43–42

S.B 252–255

arm 255–256

S.B 252–255

Rev 348

Mag 30–33

S.B. 139–138

arm 202–199

S.B 139–138

Rev 348

Mag 38–35

S.B 139–139

arm 220–234

S.B 139–138

Rev 348

Mag 40–42

S.B. 139–138

arm 252–255

S.B. 139–138

Rev 348

Mag 37–43

S.B. 139–138

arm 255–287

S.B. 139–138

Rev 348

Mag 42-49
SB 139-138
Arm 299-295
SB 139-138
Rw 347

Mag 53-47
SB 139-138
Arm 306-302
SB 139-138
Rw 347

Mag 54-60
SB 139-138
Arm 337-336
SB 139-138
Rw 348

Mag 58-63
SB 139-138
Arm 241-237
SB 91-95
Rw 347

Mag ~~91-95~~ 39-43
SB ~~39-43~~ 91-95
Arm 250-247
SB 91-95
Rw 348

Mag 46-44
SB 91-95
Arm 261-261
SB 91-95
Rw 347

Mag 50-48
SB 91-95
Arm 278-277
SB 91-95
Rw 347

Mag 51-53
SB 91-95
Arm 295-294
SB 91-95
Rw 350

Mag 51-53
SB 91-95
Arm 281-289
SB 91-95
Rw 347

Mag 56-55
SB 91-95
arm 303-302
SB 91-95
Rev 344

Mag 58-60
SB 91-95
arm 318-316
SB 91-95
Rev 347

Mag 61-64
SB 91-95
arm 322-322
SB 91 95
Rev 345

Mag 67-65
SB 91-95
arm 335-338
SB 91-95
Rev ~~34~~ 345

Mag 61-69
SB 91-95
arm 335-335
SB 91-95
Rev 346

Mag 53-49
SB 66-59
arm 239-241
SB 66 59
Rev 347

Mag 56-54
SB 66-59
arm 242-242
SB 66-59
Rev 343

Mag 57-58
SB 66-59
arm 256-258
SB 66-59
Rev 350

Mag 62-62
SB 66-59
arm 272-272
SB 66-59
Rev 349

Mag 67-68
SB 66-59
arm 276-279
SB 66-59
Rev 350

Mag 72-72
SB 66-59
Arm 284-288
SB 66-59
Rw 349

Mag 75-81
SB 66-59
Arm 299-294
SB 66-59
Rw 350

Mag 87-92
SB 66-59
Arm 312-307
SB 66-59
Rw 349

Mag 105-106
SB 66-59
Arm 320-322
SB 66 59
Rw 350

Mag 124-125
SB 66 59
Arm 342-336
SB 66-59
Rw. 350

Mag 145-144
SB 66-59
Arm 350-357
SB 66 59
Rw 349

Mag 165-169
SB 66 59
Arm 189-182
SB 31-34
Rw 346

Mag 110-107
SB 34-31
Arm 206-195
SB 34-31
Rw X

Mag 127-133
SB 34-31
Arm 205-215
SB 34-31
Rw

228 May 131-126
SB 34-31
arm 213-200
SB 34-34
Rev 340

May 141-146
SB 34-31
Arm 207-222
SB 34-31
Rev 340

May 161-157
SB 34-31
Arm 212-212
SB 34-31
Rev 347

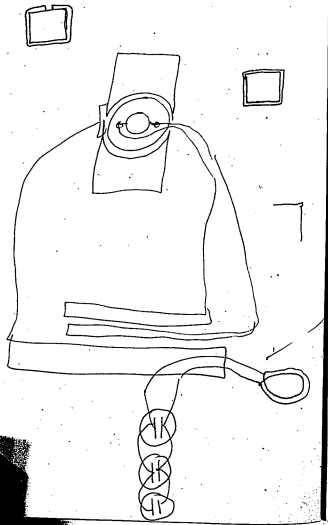
1.5) 212.0 (141
15
62
60
2

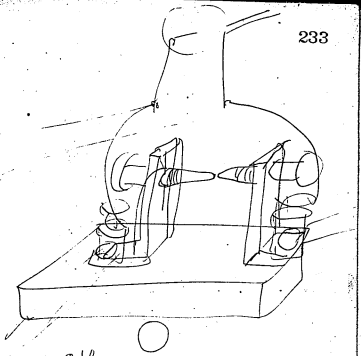
Aug 7 1851 229

Started @ 3.28
EWH 45
Rev 148

EWH 65
Rev 200

~~1015~~
Running 330
E.M.H.

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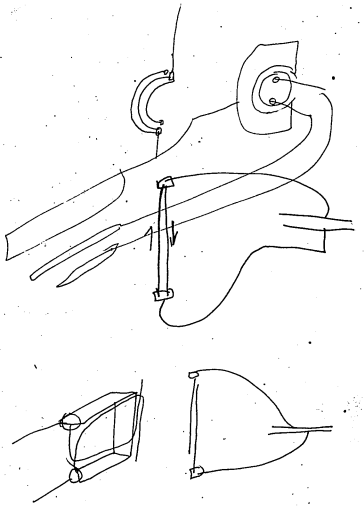
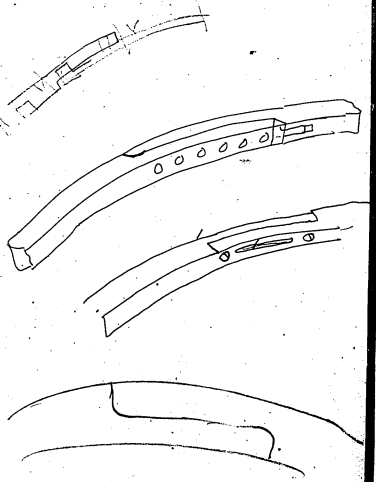
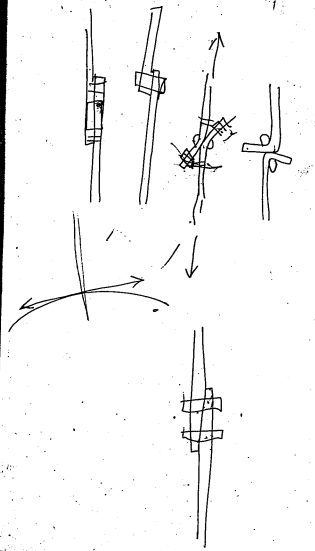






Started at 5 P.M. Stopped at 12 P.M.

Sunday Aug. 1 18

Test of the "C" Dynamo with a load of 8 barrels

Arm 78 volts
SB.
Mag 20-31
SB 32-32
Rev 340

Arm
SB
Mag
SB
Rev

Arm 119-117
SB 32-32 ~~79.5~~ 79.4 v.
Mag 30-31
SB 32-32 20.52
Dia 1
Rev 343

Arm 240-244
SB 57-68
Mag ~~164-168~~ 173-176
SB ~~175~~ 169-168
Dia 2
Rev 338

Arm 248-239
SB 57-68
Mag 65-74
SB 57-68
dia 3
Rev 334

Started

arm 247-256
SB 57-68
Mag 81-70
SB 57-68
Dia 4
Rev 341

---

arm 268-258
SB 57-68
Mag 194-183
SB 57-68
dia 5
Rev 334

---

arm 271-262
SB 57-68
Mag 90-100
SB 57-68.
Dia 6
Rev 335

---

arm 268-276
SB 57-68
mag 105 98
SB 57.68
Dia 7
Rev 333

arm 285279
SB 57-68
Mag 119-128
SB 5768
Dia 8
Rev 330

---

arm 286-293
SB 57-68
Mag 140-132
SB 57 68
Dia 9
Rev 331

---

arm 303 297
SB 57-68
Mag 149-156
SB 57-68
Dia 10
Rev 332

Stop at 1 am aug 8 1881
running 1 hour.

August 8th 1881. TAE

Experiments on the resistance of moving contacts especially in regard to Commutators and their brushes used on Dynamos –

with South Ann Moe shaft run by Gramme. at varying speeds brushes sideswise but not end on good pressure, (more than ordinary

Resistance commutator still,		055.
"	shortcircuited,	043.
"	Speed 670 Rev	065
	" 812 "	068
	915 "	072
	930 "	073.

Brushes put slightly more End on – speed.

(copy of Edison chart)

Experiments to be tried tonight
Clean Commutator

1 Runs to make experiments with the string on the indicator - field off brushes off.

2 Take diagrams with boiler pressure 90 ditto 70

3rd Run 20 minutes with brushes off - indicate by hand, no blower on (field on)

4. Cool down armature by blower then put ~~on~~ brushes on, one brush on block the other on insulation - run 2 minutes indicate - notice heat (open circuit).

5 Put on 3 barrels go to 103 volts then set commutator ahead block at a time in direction of rotation notice spark and drop in volts, use the mercury brushes.

6 Try new brushes (10) sheets without mercury

7 " " " " with mercury

8 Try wire on other brush pertwise

9 Set one brush on one side block ahead of the other brush on the same side set drop.

10 Measure resistance while running bet. 2 brushes on the same side.

(Ex 1) ~~Started 10.15~~ 9.45

B.P.

94.7.

We took 5 Cards numbered from 1 to 5 ~~of~~ with field off

Brushes off - .954 =

We now at 10.02. take Cards with field off but brushes on - one brush on insulation one on middle of block -

Now we put field on. 89 volts, seperate Machine - Brushes on - no current from machine = Brushes on - Stopped 10.42 - No. blower on - worked Cards off at diff boiler pressure 90 down to 60

118. 800 (6
708

118 800 (7
826.

We start the blower & take
Cards to see if there is any more
friction — 10 46 PM = — Stopped 10 53 —
taking 2 cards one with blower off
& 1 with blower on = 60

1 Barrell on 11 13 PM, - own field,
Hg Brushes - there no spark except very
very slight,

with one Bbl on 103.
It dropped to 94 — when ~~[illegible]~~ Barrell
Barrell put on — 2 Bbls on now —
Shutdown 27 minute to 12

4 Bbls 12.16 AM, started
12.42 " Shut Down

armature — not very hot
wooldrum that way all
day — thought we saw at spark

shut down started again
1 06 am. to see if it would
cross again. 4 barrels on.

110 B.P.

Aug 11 1881 –

Tests with Indicator and weighing Coal & water on Babcock & Wilcox Boiler, Lump anthracite – Croton water =

~~First test~~ sample friction Engine no field =

Evaporation Commenced, BP 120 –

10 51 ½ PM. — Engine started at 11 03 PM with 3 6bls on – on test = 7 alts. 103 = Besides the 3 bbls there is 9 other lamps on.

103 Volts on armature

average heat 129 deg in Gauges –

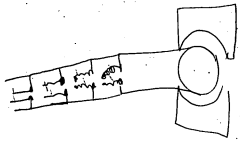
had to increase speed of blower after 2 hours run, after 4 hours had to increase it again = bobbin very hot. over

look speed of the blower — (Large size =) 1940 Revs per minute.
It will require the boring out of $\frac{1}{32}$ and air equal to a speed of the big blower 2500 per minute to keep cool —
Mercury fumes nearly off
Commutator after 4 hours run and brushes especially X

Sparks somewhat freely as it 430 AM.
Catches stuff at g. — Mercury worn off sparks nothing badly. 335

Shut down at 5.10 am —
Stopped Evaporating water at 5-17 am
OVR

Mercury wore off about 3 am
Sparked badly after that &
spattered up commutator pretty
well = Armature when stopped
not extra hot though it would not
do to let it get any hotter =
The joints or contacts were quite hot
and the bolts that goes through
plate very hot = temperature
of the contacts at 6 am 147 =
There was 6 ohms outside
of field -



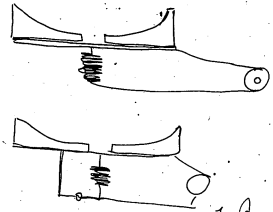
Square of the diameter × by .7854 = area.

12 × 12 = 144 × .7854 = 113.098 area

Take the average pressure from the indicator card equal (for example) 30 lbs.

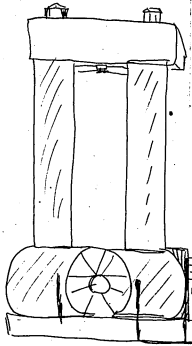
Diam of cyl = 12"
length of stroke 12"
Rev. per min = 350

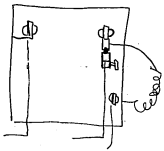
113.098
30
3392.940 = lbs pressure on piston
700 feet travel
33000) 2375580000 = ft lbs
70 H.P.



Fig

$\frac{15}{400}$ $\frac{2}{20}$ $\frac{3}{80}$ $\frac{1}{26}$





2) 65
.32

110
110
1100
100
12100
443
3630
4400
44

~~33~~) 536 ~~0 0~~ 0.0 (1
33
20

32) 53603000 (167509.0
32
216
192
280
224
163
160
300
288
20

38) 1675 ~~00~~ (51.
165
25

51 HP

2) 165
32
65
13

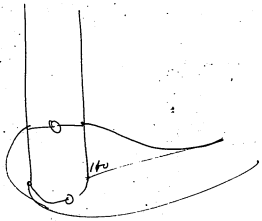
2) 1.0
4.65
.13

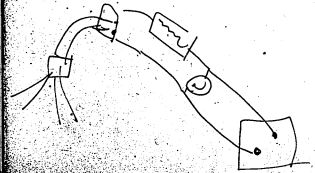
800) 1250 (.15
800
4500
4000

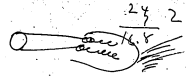
4) 65
1 20

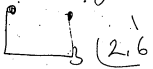
4) .65
16

800) 1250 (15
800
4500
4000

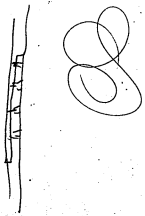








I hope I'll meet you soon again



336.

Menlo Park Notebook #224 [N-81-01-29]

This notebook covers the period January-May 1881. The entries are by Charles L. Clarke and relate to tests of steam engines and to the design of the Porter-Allen engine for the central station dynamos. The label on the front cover is marked "Steam Engine Tests" and "C.L. Clarke." The book contains 254 numbered pages. The pagination is irregular. Between pages 20 and 21 is a set of 26 pages numbered 00 through 19a.

Blank pages not filmed: 19a-254

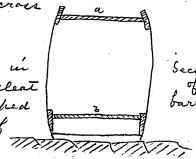
xE-172 N-81.01.29

Test of Jan. 29th 1881.

Water measured from two barrels into which it is pumped by hand and from barrels to boiler, through a Bourgman heater by a Knowles pump.

Two cleats across each barrel (a and b)

Water filled in to bottom of cleat a and pumped out to top of cleat b.



Section of barrel.

No. of Barrel	Total Weight to top of cleat b lbs.	Total Weight to bottom of cleat a. lbs.
1	115	445
2	100	462

Weight of Water { No. 1 = 330, No. 2 = 362 } Temp. 54°F.

May 25. 1881
Clarke

The Porter-Allen engine now in course of construction has cyl 11" x 16" and is to develope 125 H. P. at 350 revo. per minute.

$$\begin{array}{r} 125 \\ 33000 \\ \hline 375000 \\ 375 \\ \hline 4125000 \end{array}$$ ft. lb.

If x is mean effective pressure

$$\left(95.033 - \frac{2.4052}{2}\right) x \times \frac{16}{12} \times 350 \times 2 = 4125000$$

$$x = 47.1 \text{ lbs.}$$

= mean effective pressure.

The clearance is 7% of the piston displacement

∴ let

$C = .07 \times 16 = 1.12$

pressure $= p = 120$ lbs. ~~[illegible]~~
$= 134.7$ absolute

Area piston $= A = 95.033$ sq. in. $- 1.2026$ half the piston rod
$= 93.830$

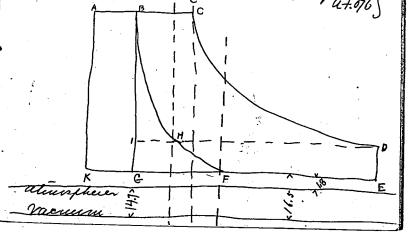
Stroke $= l = 16''$

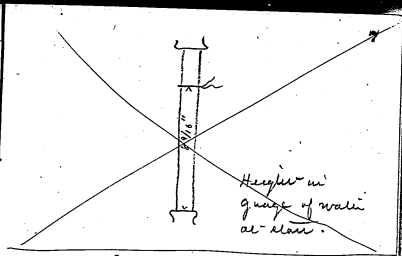
Admission $= a$

$$\text{Work} = Ap\left\{a + (a+c)\log\frac{l+c}{a+c}\right\}$$

$$C = .07l$$

$$\text{Work} = Ap\left\{a + (a+.07l)\log\frac{1.07l}{a+.07l}\right\}$$





BCDEG represents this work but there must be subtracted from it BFG for compression.

The initial pressure KA is 134.7 lbs. and terminal pressure of compression curve at F is 16.5 lbs. therefore the distance $KF = \frac{134.7}{16.5} \times KG$

and $KG = .07\,l = 1.12''$

$\therefore \quad KF = 9.1433''$

And $GF = 9.1433 - 1.12 = 8.0233''$

The mean pressure from G to F on curve B F is

$$CP \times \frac{\log \left(\frac{KF}{C}\right)}{\log \left(\frac{C}{\ }\right)} \div GF =$$

$$1/2 \times 134.7 \times 2.1005 \div 9.1433$$

$$= 33\tfrac{1}{2} \text{ lbs.}$$

The work absorbed in ~~B F C~~ is $APC \log \frac{KF}{C} =$

$$\frac{95.033 \times 134.7 \times 1.12}{12} \times \log \frac{9.1433}{1.12}$$

$$= 2509.55 \text{ ft. lbs.}$$

and for 700 reciprocations

$$= 1756687 \text{ ft. lbs.}$$

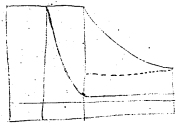
Therefore the curve B C D E G must give

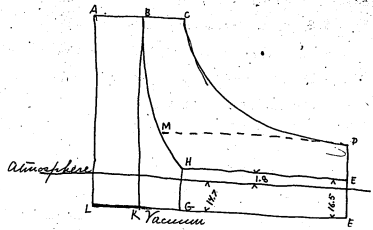
$$4125000 + 1756687$$

$$= 5881687 \text{ ft. lbs.}$$

The total work from K to F.

$$= A p c \log \frac{KF}{c}$$





~~The total work from~~

Piston Area = 95.033

" rod area = 2.4052

True Piston Area = 93.8304 = A

Stroke = 16" = l

Admission = a

Clearance = (.07)l = 1.12 = c

Absolute Pressure = 134.7 = p

The initial pressure at BK being 134.7 and terminal pressure of curve BH 16.5 lbs.

$$LG : LK :: 134.7 : 16.5$$

$$LG = \frac{LK \times 134.7}{16.5}$$

$$= 9.1433$$

$$\therefore KG = 8.0233$$

Total Work from K to G for 1 stroke

$$= ApC \log. \frac{LG}{C}$$

$$= 93.83 \times 134.7 \times \frac{1.12}{12} \times 2.\text{f}$$

$$= \cancel{2370.68} \ 2477.224 \text{ ft. lbs.}$$

and for 700 reciprocations

$$= \cancel{1659476} \ 1734057 \text{ ft. lbs.}$$

~~The remaining~~ this work is for compression and against the atmosphere from G to K

The remaining amount of work against the atmosphere is

$$HG \times GF \times A \times \cancel{\text{[illegible]}} \times 700$$

$$= 16.5 \times \frac{7.9767}{12} \times 93.83 \times \cancel{\text{[illegible]}} \times 700$$

$$= 720\,389 \text{ ft. lb.}$$

The total resistance in work excepting the external wire be

$$720\,389 + \cancel{1659476}\ 1734057$$

$$= \cancel{2379865}\ 2454445 \text{ ft. lb.}$$

To do 125 H. P. of external work there must be added 4125000 ft. lb. making a total of

$$\cancel{6504865}\ 6579445 \text{ ft. lb.}$$

Suppose we cut off at $\frac{7}{10}$ th. stroke.

Total Work

$$= Ap\left[a+(a+.07l)\log\frac{1.07l}{a+.07l}\right]$$

$A = 93.83$
$p = 134.7$
$a = 3''.2$
$.07l = c = 1''.12$

Total Work

$$= 93.83 \times 134.7\left[\frac{3''.2}{12}+\left(\frac{4''.32}{12}\right)1.377\right]$$

$= 9635.778$ ft. lbs. for one stroke and for 700 reciprocations

$= 6745045$ ft. lbs.

subtract ~~2745445~~ ft. lbs.

$= \cancel{4299600}$

$= \cancel{132.3}$ H.P. effective

130

00.

$$DF \times LE = AC \times AL$$

$$DF = \frac{AC \times AL}{LE}$$

$$DF = \frac{134.7 \times 4.32}{17.12}$$

$$DF = 34 \text{ lbs.}$$

Terminal Pressure = 19.3 lb. above atmosphere.

If there had been no clearance

$$DF = \frac{134.7 \times 3.2}{16}$$

Terminal Pressure = 26.94

= 12.24 above atmosphere.

Also the amount of latent work done would be

$$= A p a \left\{ 1 + \log \frac{l}{a} \right\}$$

$$= 93.83 \times 134.7 \times \frac{3.2}{12} \left\{ 1 + 1.6094 \right\}$$

= 8794.65 ft. lbs. and

for 700 reciprocations

= 6156257 ft. lbs.

and subtract from this the resistance of atmosphere and back pressure during stroke (for there will be theoretically no compression with no clearance)

Resistance

= HG × KF × A × 700

= 1444982 ft. lbs.

leaving 6156257 − 1444982

= 4711275 Total external work

= 142.8 H.P.

Thus in the two cases with equal amounts of steam the power developed without clearance is

142.8 H.P.

With clearance 7%

130 H.P.

or a loss of 9%.

Suppose an admission of $\frac{3}{10}$ of the stroke = 4.8" at 80 lbs. initial above atmosphere or total of 94.7 lbs.

Initial pressure at BK being 94.7 and terminal pressure of curve BH 16.5 lbs.

$$LG = \frac{LK \times 94.7}{16.5}$$

$$= 6.429''$$

$$\therefore \quad KG = 5.309''$$

Total work from K to G for one stroke

$$= A\,p\,c \log \frac{LG}{c}$$

$$= 93.83 \times 94.7 \times \frac{1.12}{12} \times 1.7875$$

$$= 1449.258 \text{ ft-lbs.}$$

and for 700 reciprocations 3

= 1014480 ft. lb.

This work is for compression and against the atmosphere from G to K.

The remaining work against the atmosphere is

HG X GF X A X 700

= 720389 ft. lb.

The total resistance in work excepting the external will be

720389 + 1014480

= 1734869 ft. lb.

To do 125 H.P. of external work there must be added 4125000 ft. lb. making a total of

5859869 ft. lb.

Suppose we cut-off at 3/10 of the stroke

Total Work

$$= Ap\left[a+(a+.072)\log\frac{.072}{a+.072}\right]$$

$A = 93.83$

$p = 94.7$

$a = 4.8''$

$.072 = c = 1''.12$

Total Work

$$= 93.83 \times 94.7\left[\frac{4.8}{12}+\left(\frac{5.92}{12}\right)1.062\right]$$

8209.675 ft. lbs. for one stroke, and for 700 reciprocations

= 5746772 ft-lbs.

Subtract 1734869

= 4011903

= 121.6 H.P.

Suppose we cut off at $\frac{37}{100}$ stroke

$A = 93.83$
$p = 94.7$
$a = 4.96$
$c = 1.12$

Total Work

$$= 93.83 \times 94.7 \left[\frac{4.96}{12} + \left(\frac{6.08}{12} \right) 1.0367 \right]$$

$= 5322.294$ ft. lb. for 1 stroke

and for 700 reciprocations

$= 3725606$ ft. lb.

Subtract 1734869

$= 4090737$ ft. lb.

$= 124$ H.P.

Suppose we cut-off at $\frac{315}{1000}$ stroke

$A = 93.83 \cdot p = 94.7$

$a = 5.04''$ $c = 1.12$

Total Work $= 93.83 \times 94.7 \left[\frac{5.04}{12} + \left(\frac{6.16}{12}\right) 1.0222 \right]$

$= 8378.58$ ft-lbs for 1 stroke

and for 700 reciprocations

$= 5865000$ ft-lbs.

per minute 1734869

$= 4130141$

$= 125$ H.P.

Suppose we cut off at

$\frac{33}{100}$ of stroke

$a = 5.28''$

Force Work =

$$93.83 \times 94.7 \left[\frac{5.28}{12} + \left(\frac{6.4}{12} \right) \overset{98395}{\cancel{11765}} \right]$$

$= \overset{85572.66}{\cancel{94464}}$ ft-lb. for 1 stroke

for 700 reciprocations

$= \overset{6000086}{\cancel{6638470}}$ ft. lb.

subtract 1734869

$= \overset{4265993}{\cancel{4404101}}$

$= \cancel{1456}$ H.P.

129.27 H.P.

Outside work.

Suppose we cut off at $\frac{32}{100}$

$C = 5'.12''$

Work =

$$93.83 \times 94.7 \left[\frac{5.12}{12} + \left(\frac{6.24}{12}\right) 1.009 \right]$$

$= 8453.$ ft. lbs. for 1 stroke

and 700 reciprocations

$= 5917324$ ft. lbs.

Subtract 1734869

$= 4182455$

$= 126.7$ H. P.

See page 11a where the cut off is $\frac{33}{1000}$ of stroke.

$$DF = \frac{AC \times AL}{LE}$$

$$DF = \frac{94.7 \times 6.4}{17.12}$$

$$DF = 35.4$$

Terminal pressure above atmosphere

20.7

If there had been no clearance

$$DF = \frac{94.7 \times 5.28}{17.12}$$

$$DF = 29.2$$

Terminal pressure above atmosphere

14.5

Also total amount of work done $= Apa\left\{1 + \log \frac{r}{a}\right\}$

$$= 93.83 \times 94.7 \times \frac{5.28}{12}\left\{1 + 1.1056\right\}$$

= 8244 ~~reciprocations~~

for 1 stroke

= 5770800 ft.lb. for

700 revolutions.

deducting the atmosphere and

back pressure work –

1444982 ft.lb.

= 4325818 ft.lb.

= 131 h.p.

With clearance the developement was 129.27 H.P

a loss of 2%.

Menlo Park Notebook #225 [N-81-06-10]

This notebook covers the period June 1881-February 1882. It contains statistics relating to the canvass of the second district by the Edison Electric Illuminating Company of New York. Included also is an index to the canvassers' books. The label on the front cover is marked "General Index" and "Statistics." The book contains 280 numbered pages.

Blank pages not filmed: 28-29, 48-49, 54-59, 62-63, 66-69, 74-279.

Dist 2 from Book 4 2nd book

Block 123

	Number of Dwelling Houses in Ward	Totals	Hotel waiters
Front St			
62	20	20	1
64		3	1
66		3	1
68 870		x	x
72		2	1
74			1
Oleander			
27		4	1
25			1
23			1
21		4	
19		x	x

{ Therefore 9 pages are only head of record }

District 2.

Block 6

	Carpets	Beds
South St		
39½ Quarley	9 2	11 2 9
Front St		
71/75	5	3
67/69	3	1
65	x 28	1 5
63		1
61	1	1
59	3	1
57	3	1
55 54		1
53	7	25 H 1 5

Block 5

District 2.

Block 5	Carpets	Beds
Front St		
51	15	1
47 & 49	8	1
45		1
43		
41	10 33	3
"	5	1
Coenties Slip		
20	3	
22	6	
24½ "	9 3	
26	5 31	1

Dist 2.

Block 4	Gas jets	Meters
South st		
23/2	12	1
23	5	
24/25	10	2
26	23 28 57	3
27	7	1
28	6	1
B5		
29	4	1
29	4	
30	21	1 4
31	8	1
32	4	1
33	12	1 3

Dist. 2.

Block 5	Gas jets	Meters
South st		
35/4	16 3	1
36	4	1
37		1
38		1
39		1
	23 12	3 3
Old slip		
31	3	
29		1
27	2	
B20		
Broad st		
101	11	
101½/103		1
B. 14		
105/109	21 19	2
105½/109	5	
Water st		
28	4	1
30	7	1
32		1
34		1
	16 34	4 8

Block 20	Gas fits	Water	
Water St			
36		1	
38		1	
40	6	1	
Counter's alif 5	3	1	
3	3 12	1	5
1	63 53		
Pearl St			
64	7	1	
62		1	
60	2 × 20	×	2
B21			
Water St			
58	8	1	
B14			
Broad St			
107		1	
109/111			
Front St			
26		1	
28		1	
30	8	1 5	

Block 14	Gas fits	Water	
Front St			
30	7		
32 & 34		2	
36 & 13+15 Counter's alif		1	
Front	5		
38			
40	5		
Counter's alif 13 & 15 rear	10	1	
38 Front	27 7	35	4 5 9
Counter's alif			
11			
9			
7	7		
Water St			
37 1/2	1		
37	4	1	
35	10 22	1	

Block 44	Gas Jets	Meters
Water st-		
33		1
31	2	1
27	2	1
25		1
23	4	1
B.3		
Broad st		
113 & 115	5	
117	3 13	1 5
119 & 121	2	1
123	14	1
125/127	43 31 24	3
125/127	12	
"	4	
"	2	1
"	2	
South	20	1
17	×	×
"	21	
18	10	1
19	31	1

Block 33	Gas Jets		
South st-			
20	15	1	
31		2	
22	10 6 1		
Beaver alley 31	6 33	3	
29			
27		1	
25		1	
23	16		
21	6 22	2	
19	14		
Trout			
37	8		
35	2	1	
33	2	1	

Canvassing books on hand June 10th 1881

Number of the Canvassing Book	Ward	Number	Books	Why Illegible	Number of Statistics
1	1	1	10, 20, 23, 26, 33, 35, 37	2. Spaces 1. 200 Book 1 given to Grants 11/5/81	
2	"	2			52, 42, 34, P27
3	"	3	P18, 19, 24		
4		4	26, 27, P29, 7, P18		
5	"	5	P8, 8, 9		
6	"	6	7		
7	"	7	P6, P7		
8	"	8	11, 23		
9	"	9	25, 26.33, 41.42 P, P31		
10	"	10	P32.39, 40.47, 48		
11	"	11	P21, 22, 37, P32		
12	"	12	P5, 15, 16		
13	"	13	P5, 4		

received sept. June 10

Book No	Ward	Number	Books	Why Illegible Number	Number of Statistics
14	1	14	3, 14, P4		
15	"	15	P3, 12, 30, P33		
16	"	16	36, 37, 38, 44, P45		
17	"	17	46, 36, 46		
18	"	18	P, 12, 29, P34		
19	"	19	P, P, 11, 12		
20	"	20	P11		
21	1	21	24, 0.1		
22	1	22	P1		
23	2		46, 47, 50, 57, 45	1 walk	
24	2	24	7, 12	117 walk	
25	2	4	12.4, 20, 14, 3.2, 15, 16, 15.1, 22, 30, 33	62 3 out, 54, 17, 31, 32, 48	1.54

Canvasser's Books
recd up to June 10. 1881

Canvasser's No.	Brick	Frame	Blocks	1st Division Amount Received	1st Division Amount Due	2d Division Amount Received	2d Division Amount Due
26	2	3	25.26, 29.32, 42.	40.3 Way			
27	28		7.11, 27.32.8, 27.22.3, 17.12.	25 W. 32	Vol 1. Joe 100		
28	28		15.24, 29.34, 37.	25 W 29			
29	28		13.18, 23.28, 33.38, 28.12, 28.12.	27 E 26			
30	34	36 37	33.36, 43.46, ~~31.34.50~~ 37 W 5	4			
31	28		1.5, 5.14, 17.	250.5 th ave			
Recd June 11							
32	28		10, 16.23, 24.31, 36.26	462. 6th ave			
33	2		35.36, 39.34, 50.	11 Morris			
34	2		43.44, 62.21, 64.	65 Way			
Recd June 17							
35	28		39.45, 46.40, 35.	209. 6 (32)			
36	35 38		39.40, 22.26, 2.	101. 8. 56			

Mr Lynn took 22 June
Recd 5.50

Canvasser's No.	Brick	Frame	Blocks	1st Division Amount Received	1st Division Amount Due	2d Division Amount Received	2d Division Amount Due
Recd June 27							
Dec 4					6 Books		
37	28		37.32, 27.32, 44.		6th ave 30th st		30.25
38	28		10.19, 20.		100 to 27th		
39	3		2.4.		3.2.1.7.8.9.10.11.13.12.18.17. Trinity Church		
40	34		6.15.16, 25.				
41	34 37		34.35, 36.43, 24.5, 12.17, 22.7.6.		8.8.56 32 W 55		
42	31		1.5.10, 15.26.		488. 8th ave		
Recd June 30. 2 Books							
43	3		10.16, 22.26.		113 Bridge		
44	38 35		1.13.14, 27.30, 38.50, 57.62.		134.8.56		
Recd July 2. 1 Book							
45	31		20, 25, 30, 35, 39, 45.		530. 7th ave near 38th st		
46	38		15, 29, 39.				
Recd July 5. 1 Book							
Recd July 7. 1 Book							
47	3		24, 30, 31.				

Assessor's No.	District	Blocks	Blocks	1st Buildings (numbers)	1st Buildings (numbers)
		July 14th Reed 1 Book			
48	34	1		26.40	
		9		44.Lee	
		10			
		19			
		20			
		July 15 Reed 1 Book			
49	31	44			
		40			
		34			
		31			
		26			
		21			
		16			
		11			
		6			
		2			
		41			
		July 18 Reed 1 Book			
50	3	5			
		6			
		19			
		20			
		21			
		July 20 Reed 1 Book			
51	34	4			
		5			
		14			
		15			
		24			
		25			
		3			
		6			

Assessor's No.	District	Blocks	1st Bldgs (numbers)
		July 21. Reed 3 Books	
52	3	26.27.28.29	
		32.33	
		Rein	
		18.19.20.21	
53	3	34.35.36.43	
54	3	31.40.41.42	
		52.53	
		July 25	
		Reed 3 Book 1	
55	31	4.9.14.19.24	
		29.34.38.43.47	
		46.42.	
56	32	1.7.13.19.25	
		31.37.43.49.51	
		57.52.44.33.32.	
57	3	(W. Washington Market 54)	
		July 30 Reed 1 Book	
58	34	20.21.28.29.41 (Correction Aug 1.) (Book Book 31.40.43)	
		Aug 2. Reed 3 Books	
59	30	5.10.15.20.	
60	31	41.37.32.27.22.17	
		12.7.	
61	34	6.13.16.23.26.	
		Aug 6 Reed 1 Book	
62	34	26	

Book	Sect	Blocks	
		1 Book Recd Aug 19	
63.	30	1.6.16.11	
		46.47.42	
		37.38.27	
		22.17.12	
		7.2.48	
		43.38.	
		21.17.26.14	
		31.17.36.17	
		41.17	
64	5	blue Book Recd aug 18 1.2.3.4 5.6.7	
		Aug 20 Recd 3. Books	
65	3	44.45. 46.51 50.49 48.47	
66	30	26.25 30.35	
67	34	12.17.22 27.	
		Aug 24 Recd 1 Book	
68	30	33.28.23 13.13.9.8 49.44	
		Aug 27 Recd 1 Book	
69	7	22.17.23. 24.	
		aug 29. Recd 2 Books	
70	30	44.39.34 29.24.19	

Book	Sect	Blocks	
71	30	40.45 50.4	
		Aug 30 Recd 2 Books	
72	30	9.14.20 Oil Lamps	
73	30.	19.14.	
		Aug 31. Recd 1 Book	
74	5	21.22.23 24.25.26 27.28.29	wrote Russel about the work of Bacon in the figure in the B
		Sept 12th Recd 1. Book	
75	5	30.31.32 33.34.41 40.37.38 37.36.35 42.	
		Sept. 14. Recd. 1 Book	
76	20	42.33.34 35.36.38 41.40.39 37.31	
		Sept 17. Recd 2 Books	
77	5	43.44.45 46.47.8 Plan	Fowler
78	7	24.28.29 30.46.48	Levinson
		Sept 17 Recd More Book Plan	
79	5	20.19.18.	Fowler

Book	Bill	Blocks	Cawesser
		Recd 3 Books sept 19.	
80	5	8.9.10.11.12.13 14.15	Waters
81	20	1.2.3.4.5.6 7.8.	G. Brown
82	7	2.21.26.25 31.45.49.3 18.19.26.	Parham
83	5	15.16.17	
84	20	31.32.27.28. 29.30.26.25. 24.23.	Wm Brooks.
85	20	9.10.11.12.13	G. Bruin
86	7	48.47.52.53. 54.55.56.42	J. F. Lennon
87	7	32.43.51.	Parham
88	20	13.14.15.16.17. 18.	Waters. G. Bruin.
89	20	23,22,21,20	Wm. Brooks.
90	20	18,19.	G. Bruin.

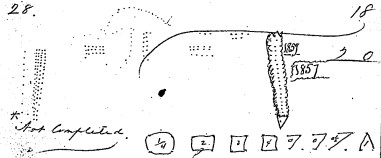
1881 Book		Div		
		14	Blocks	Canawaker
91	24	11	1	Monroe Dobbleday
92	24	12	5.9.	Dobbleday
93	7		42.41.40. 39.38.37. 33.34.35	Lennon Waters
1881 Oct 15 94	24		9-13	Doubleday
15 95	21		1, 2, 3. 4. 5. 6.	Brooks
15 96	7		35. 36. 37. 16 15. 14. 13. 12. 17. 4.	Waters.
15 97	21		35. 36. 37. 38. 39. 31. 32. 33.	Irwin
20 98	7		4. 5. 6. 7. 8. 9 11. 10	Waters
20 99	21		6. 7. 8. 9. 10. 11 12. 13. 14. 15	Brooks.
21 100	21		33. 34. 20. 21 22. 23. 24	Irwin
22 101	24		13. 17. 21.	Doubleday.
24 102	21		15. 16. 17. 18. 19.	Brooks.
26 103	21		24. 25. 30. 26. 27. 28 29.	Irwin
28 104	24		25. 29. 2. 6	Doubleday
Irwin 105	29		6. 12. 18. 29. 35 41. 47. 53. 59 38. 42. 46.	Brooks.

State	No. Book	District	Blocks	Comprises
Nov. 4	106	29	36. 42. 48. 54. 1. 7. 13. 19. 24. 30.	G. Dorrance
" 4	107	25	12. 3. 4. 5. 6. 7. 8. 9.	G. H. Waters
" 4	108	29	17. 11. 46. 40. 34. 28. 23.	H. Brooks
" 5	109	24	6. 10. 14. 18.	Shubleday
" 9	110	29	11. 5. 4. 10. 16. 22.	H. Brooks
" 12	111	25	14. 15. 16. 17. 18. 9. 10. 11. 12. 13.	G. H. Waters
" 18	112	29	31. 25. 20. 54. 55. 49. 43. 37.	G. Dorrance
" 21	113	29	45. 51. 22. 27. 33. 39.	H. Brooks
" 25	114	24	18. 12. 26. 30. 31.	H. Shubleday
Dec. 7	115	29	21. 26	
	116	29	38. 32. 51. 57. 56. 50. 44.	
	117	29	14. 8. 2. 3. 9. 15	

1881 Date	No.	Book	District	Blocks	Canvasser
Dec		118	† 24	11.7.3.4.8.12.16.	Brown / Doubleday
"		119	* 25	19.20.21.22.23.	Brown / Waters
"		120	24	31.27.23.19.15.	Doubleday
"		121	32	41.42.49.56.61.60.55. 6.12.18.24.30.36.	Brooks
"		122	32	35.29.23.17.11.	"
1882.		123	32	5.4.10.16.22	"
Jany 5		124	32	28.34.40.46.54.	"
17		125	32	27.21.15	"
"		126	32	26.20.14.8.2.3.9	Brown
18		127	32	59.58.53.45.39.33	Brooks
24		128		12.18.23.36.47.46.35.22.	"
		129		32.31 ~~40~~ 33.20.9. 12.11.10.21.34.45.44	"
Feby 8		130	25	24.25.26.27.28.29.	Brown
" 15		131	12	8.7.14.6.18.30.43.42.	Brooks
		132	25	Special Call back.	Brown
		133	12	29.17.5.4.16.28.	Brooks

57 January 1st 1882

Districts Canvassed	Total number districts
1, 2, 3, 5, 7, 20, 21, 24, 25, 29, 30, 31, 32*, 34, 35, 37, 38, 28.	38



† Blocks 24, 25, 26, 27, 28, 29 ~~[illegible]~~ 25th District finished

* Blocks 1, 3, 4, 8, 12, 16, 28, 24, 28 not finished 24th District

Date	No. Book	Volume	Blocks	Comments
July 20	134	24	20.24.28	
"	135	12	37.24.38.25	G. Jamin
"	136	12	111.40.27.15.3.2.14	Brooks
Aug 7	137	12	26.39.13.1	"

Book, Prot. ufn. 255

July 5/82

118, 134, 120, 109, 104 } div eq
91, 94, 92, 101, 114,
108, 116, 115, 117, 112 } div eq
106, 110, 113, 105
107, 111, 119, 130, 132 } D 25
76, 84, 85, 88, 85 } D 20
90, 81

Districts and Blocks, with reference to Canvassers Books

DIST 1

Block	Canvassers Books	Block	Canvassers Books
1	21.22	18	4.5
2	21	19	4
3	15	20	1.
4	13.14	21	11.12
5	12.13	22	11
6	6.7	23	8.9
7	~~6~~ 7	24	4
8	6	25	1.2
9	5.6	26	9.
10	1.	27	4.
11	19.20	28	2.
12	18.19	29	18
13	15	30	15.16
14	14.	31	10.11
15	12	32	10.11
16	12	33	9
17	7.8	34	8

All this is upon chart

DIST. 1

Block	Canvassers Books	Block	Canvassers Books
35	2.		
36	16.17.18		
37	16.		
38	16		
39	10.		
40	10.		
41	9		
42			
43	2.		
44	16.17		
45	16		
46	17?		
47	10		
48	10		
49	9		
50			
51	2.		

Dist 2.

Block	Canvassers Books Block			
1		18	29	
2	34	19	28	
3		20		
4		21		
5		22	27	
6		23	29	
7	27	24	25	
8		25		
9		26		
10		27	27	
11	27	28	29	
12	27	29	28	
13	29	30		
14		31	31	
15		32	29	
16		33	25	
17	27	34	28	

Dist 2.

Block				
35		52	26	
36	33	53		
37	27, 29, 33			
38	29 33			
39	28 33			
40				
41	34			
42	29, 34			
43	26, 29, 34			
44	34.			
45	23, 26			
46	23, 29			
47	23, 29			
48	26			
49	26			
50	23			
51	23			

Dist 3.

1	39		
2	39		
3	39		
4	39		
5			
6			
7	39		
8	39		
9	39		
10	39		
11	39		
12	39		

Block			
13	39	30	
14		31	
15		32	
16		33	
17	39	34	
18	39	35	
19		36	
20		37	
21		38	
22		39	
23		40	
24		41	
25		42	
26		43	
27		44	
28		45	
29		46	

47		1	
48		2	
49		3	
50		4	
51		5	
52		6	
		7	
		8	
		9	
		10	
		11	
		12	
		13	
		14	
		15	
		16	
		17	

Dist. 4

Block. Canvassers Book	Block
18	35
19	36
20	37
21	38
22	39
23	40
24	41
25	42
26	43
27	44
28	45
29	46
30	47
31	48
32	49
33	50
34	51

Dist 4 Dist 4

Block	Block
52	69
53	
54	
55	
56	
57	
58	Dist 5
59	1
60	2
61	3
62	4
63	5
64	6
65	7
66	8
67	9
68	10

Missing Blocks

List 2)

Block 5
6
13
21
2
3
4
5
6
7
8
35
53

List 3

Block 4
44
45
46
47
48
49
50

List 2)

3
4
8
9
13
14
18
19
23
24
25
28
29
30
33
34
35
39
40
44
45
49
50

ACR 3

8

13

18

23

28

33

~~38~~

~~43~~

~~48~~

ACR 2)

3

4

5

6

8

9

10

11

12

14

15

16

17

18

20

21

22

23

24

Vol 32

Ser 26
27
28
29
30
33
34
35
36
39
40
41
42
45
46
47
48
~~50~~
50
53
54
55
56
58
59
60
61

Vol 34

Ser 8
11
17
22
27
30
31
32
37
38
39
40
41
42
47
48
49
~~50~~
51

44 bin 35

Dec 2
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26

bin 35

Dec 27
28
29
30
31
32
33
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35
36
37
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41
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43
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57
58

46 Oct 35

Beds 59
60
61
62

47

$.625 = \frac{625}{1000} = \frac{125}{200} = \frac{25}{40} = \frac{5}{8}$

$.000236 = \frac{236}{1,000,000}$

$\frac{66}{1} \div \frac{2}{3}$

600 .006000
4200 .00980
106,000 .07600
1,400 .00300

$\frac{33}{1} \times \frac{3}{2} = 99$

$\frac{2}{3} \div \frac{66}{1}$

$66\frac{2}{3}$ 3)12,266.093800 — 38 3)100(2

$6\ 44\frac{4}{9}$ 9)466 9)36 9 $\frac{4}{9} \div \frac{10}{1} = \frac{40}{9}$

$\frac{4}{9}$ 9)98 $\frac{2}{9}$ 300 8

9)300(

3)300 100%

9)12 10 $\frac{2}{9}$ 3)41 4 $\frac{10}{3} = \frac{200}{3} = 66\frac{2}{3}$

9)400(44 36 90 36 4

$\frac{2}{3} \div \frac{100}{1}$ 1 100 98 18 2

$\frac{2}{3} \div \frac{10}{1} = 20\ 66\frac{2}{3}$

To find particulars of any building — find it on the general plan or map (lithograph), and note the district and Block.

Then refer to chart A, where will be found, at the top, the districts by number 1 to 38, (from the Battery to 4th st), and upon the left hand margin the Block numbers; where the Block line meets the District column, the number of the original book written by the canvasser will be found. These books are numbered consecutively upon their reception, on a small gummed label,

all removals of Blocks from one District to another will be noted upon the general map by blue figures, and lines; and the number of the block, (as it will be noted in the new district) will be increased by 100, so as not to have any duplicates, and any block bearing a number higher than 100 does so on account of such change.

Street Numbers

In all the streets from 14 to 59 the Even numbers are on the South side.

Avenues

1 O-E

2 O-E

3 E-O

Lex E-O

4 E-O

Madison E-O

5 E-O

6 O-E

7 E-O

8 O-E

9 O-E

10 O-E

11 O-E

12

Riverside O-E

1/4-1 3/4

Rough estimate of
Acreding in 28th Dist —

24
to 34

10 full blocks
8 by 7 — 800
7 by 6 — 800
6 by 5 — 920
J. T. Mag 500
2920

5 houses to 100 ft
1560 on each street on each side
2
2920 on each street
10
2920 if avg 20 x 100

2 line houses say 2½ x 2900 = 5800
lines 1450
7250

if 50 on page = 145 pages to
record

Men and Bat

Aug 18/51

Jas Waters	5
Lowler	5
Lemon	7
Parham	34
Brooks	30
Drum	30

Pigeon Holes

Fronts 28 Dist	Lights 28 Dist
1st Dist Claudius	1st Dist Claudius
Fronts 1st Dist used	Fronts 1st Dist not used

Pigeon Holes
plans hung upon wall

Fronts 28th Dist (2)	Lights 28th Dist (3)	(4)	(5)	Unused Plans
Fronts 1st Dist used (6)	Fronts 1st Dist not used (7)		(8)	
1st Dist Claudius (9)	1st Dist Claudius (10)	Canvasses (11)	(12)	

Drawers in close

4 Perry	1) Canvasser Book, 1st Dial
5 Supplies etc.	2) 2.8 Dial & Record Books
6. atlases Insurance 1 & 2	3 Rolled plans etc

7) Canvasser Book,	8) atlases 3 & up town

To find what blocks are rows – see days clock & week paper –

$$\begin{array}{r} 286 \\ 47 \\ \hline 333 \end{array}$$

$2\frac{3}{4} - \frac{3}{4} \cdot 5$

$1\frac{1}{2}\ \frac{1}{3} - 1\frac{1}{4}$

$\#\frac{8}{2}\ \frac{1}{4}\ \frac{8}{1}\ \frac{1}{2}$

$\times$

$\frac{25}{4} - 1\frac{1}{4}$ $\quad \frac{1\frac{1}{4}}{\frac{3}{4}} = \frac{5}{3}$ $\quad \frac{15}{4} = 4\frac{1}{2}\ \frac{1}{2}\ \frac{1}{4}\ \frac{1}{2} - 1$

Menlo Park Notebook #226 [N-81-06-22]

This notebook covers the period June-August 1881. The entries are by Charles L. Clarke and consist of notes, calculations, and drawings relating to motors and dynamos. The label on the front cover is marked "Motors" and is stamped "Charles L. Clarke." The book contains 274 numbered pages.

Blank pages not filmed: 46-274.

X E-172 N-81-06-22

Clarke
June 22, 1881

Suppose that a $\frac{14}{100}$ ohm dynamo gives 110 volts at 1200 revolution. Then to return $\frac{9}{10}$ of the energy developed in armature as a motor ($\frac{1}{10}$ being lost as heat and there being 110 volts on the line) the counter E.M.F. must be $\frac{9}{10}$ of 110 volts = 99 volts and active E.M.F. = 11 volts.

The amount of work returned by motor will be

$$\frac{99 \times 11}{.14} \times 44.3 = 3445.91 \text{ ft. lb.}$$

$$= 10.44 \text{ H. P.}$$

To give three horse power it would require a resistance of

$$R = \frac{99 \times 11 \times 44.3}{99000}$$

$$= .4873 \text{ ohms.}$$

With the regular $\frac{14}{100}$ ohm dynamo the value of 1st of cutting wire at 1000 ft. cutting speed per minute is .24 volts taken on the Bar of calculation line with a product of current by turns on magnet equal to 4700.

If armature is five inches in diameter at 1800 revolutions per minute the cutting speed will be

$$\frac{3.1416 \times 5}{12} \times 1800 = 2356 \text{ feet}$$

and the value of 1st of cutting wire =

$$.24 \times 2356 = .5655 \text{ volts}$$

and for 99 volts counter E.M.F. the requisite length of cutting wire is

$$99 \div .5655 = 175 \text{ feet.}$$

Chester, June 23 1881

To have a resis. of .9873 ohm one side of the armature of 175 ft. length should have a resis. of .9746 ohms

$$.9746 = \frac{10.64 \times 175}{m}$$

$$\text{cir. mils} = \frac{10.64 \times 175}{.9746}$$

$$= 1910 \text{ cir mils.}$$

or /wire = .0437" diam.

Carpenter

This is without counting in the winding on the ends, which will add to the resistance. See page 13

~~Take No. 18 B.W.G = $\frac{49}{1000}$" as a basis for calculation. with double covering the size will be .059"~~

Clarke, June 23, 1884

With 10 inches of cutting face suppose armature.
With this length of wire there would be required

$$\cancel{175 \cdot \frac{10}{12} \cdot x}$$

$$x = \frac{175 \times 2}{\frac{10}{12}}$$

$x = 420$ turns of wire

Call it 425 turns with 25 commutator blocks
Then there will be 50 divisions.
With diam of 5", circumference is 15.7 and with 50 divisions and $\frac{1}{32}$" separation the available circumference is 14.14" = .283" for each division

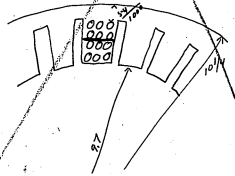
Clarke, June 23, 1891

There will be 9 wires in each division with covering ~~[illegible]~~ and wire = .05" diam. which admits of 5 wires on bottom layer and four top

O diam. = .059

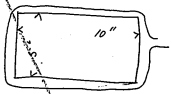
Usually fs-in. .859 × 1-4 .291

The regular $\frac{14}{100}$ hm dynamo has the following construction



O diam. = .057

Clarke
June 23, 1887



The entire length of wire for one turn will be 30" =

2.5 ft.

and for 425 turns =

1062.5 ft

The resis. of wire of this length and $\frac{49}{1000}$" diam. will be

$$R = \frac{10.64 \times 1062.5}{(49)^2}$$

$= 4.7$ ohms

but halved and in multiple arcs $= \frac{4.7}{4} = 1.175$ ohms.

This is much too high.

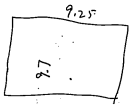
~~Let us take the wire which is $\frac{58}{1000}$ diam. (No. 17 B.W.G.)~~

~~The resistance wire be~~

$$\cancel{R = \frac{10.64 \times 1062.5}{4 \times (58)^2}}$$

~~R =~~

Clarke. June 24 1881



The armature of a $\frac{14}{100}$ ohm dynamo has 37.9" of wire for one turn and for 75 turns there are 236.9 ft.

(× 37.5) Jehing Sanke number

In practice, however, with $\frac{14}{100}$ ohm dynamo it is:

found that the length by calculation is

$$L = \frac{(42)^2 \times 6 \times .28}{10.64}$$

$$L = .287 \text{ feet-}$$

then being 6 strands of $\frac{42}{1000}$ wire.

The length on the face is 18.5 and for 75 turns (x 3 x 2 being double around) is 115.6 feet- leaving by calculation by measured distance 121.3 feet- and by calculation by measured resistance.

171.4 feet, a difference for the ends of 50.3 ft. which is an addition of 41% to the distance taken from measured distance

and is due to the winding at the ends being curved over the shaft.

The ~~dyno~~ motor in question has an armature 6" diameter and 10" face.

To get 175 feet of cutting wire it is necessary to have a number of layers of wire in series on the face of the armature equal to

$$\frac{12 \times 175}{10} = 210$$

~~and to do this there will be required 105 turns~~

~~Make it 108 turns and if there are 6 turns to one commutator there will be 18 commutators.~~

The additional length due to ends for one turn will be 10" and for 108 turns equal to 1080" to which add 417. the length is 1522.8" =

127 ft.

Total length is

127 + 175 =

302 ft.

This should have a resistance of .9746 ohms.

$$.9746 = \frac{10.64 \times 302}{m}$$

$$m = 3297$$

$$\text{diam} = \sqrt{3297} = .057''$$

The nearest B.W.G is No. 17 = .058

Charles June 25. 1841

With 10 strands to a commutator the number of commutators will be 21.

On the ends the additional length due to the larger on face will be 5" and for 210 lengths will be 1050" to which add

41% = 1480" = 123 ft.

Making a total of 175 + 123 = 298 feet.

This should have a resistance = .9746 ohms.

$$.9746 = \frac{10.64 \times 298}{m}$$

$m = 325.3$

diam. = .057"

The nearest wire is $\frac{58}{1000}$"
= No. 17 B.W.G.

Circumference of armature
15." 708

Make the insulation $\frac{15}{1000}$"
which make total diam of one
strand of wire = $\frac{73}{1000}$"

With 5 strands in bottom layer.
The total number in entire
circumference will be 105 × 2
= 210 And space taken
by same wire be
210 × .073 = 15.33
This will not give space
enough.

Suppose 12 strands to a
commutator and 204 strands
instead of 210, then then

Clarke from 25.18

will be 19 commutators

The total length of wire will be ~~increased~~ decreased from 298 ft. to $\frac{298 \times 210}{290}$

$= 216$ ft.

The resistance will be

$R = \frac{10.64 \times 216}{3364}$

$R = .68$ ohms which is not a deviation from .9746 of much account and leaving a Combi. F.M.F. of 2.970.

Suppose 4 strands and 3 strands deep = total of 12

The total number in bottom layer will be 136 strands

$136 \times .073 = 9.93''$ leaving for separation

$15.705 - 9.93 = 5.778$

or for each $5.778 \div 34 = .17$

Suppose the wire in two layers of 6 strands each, the total number in bottom layer will be 17 X 2 X 6 = 204

204 X .073 = 14.892

leaving for separation

15.708 − 14.892

= .816

.816 ÷ 34 = .024" = each space

by making the insulation $\frac{3}{1000}$ the diam. of wire is

= .071"

204 X .071 = 14.484

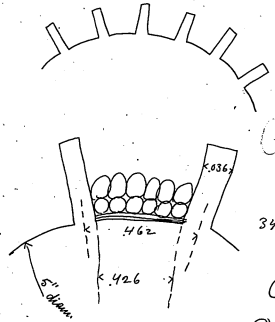
Separating space =

15.708 − 14.484 =

1.224"

and for each

1.224 ÷ 34 = .036" which is sufficient.



O.K.

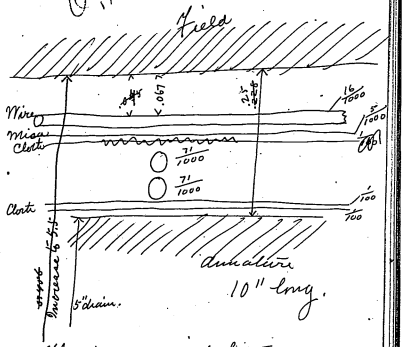
34 divisions

Omit $\frac{88}{1000}$

2 layers of cloth on armature each $\frac{1}{100}$" thick

Omit insulation $\frac{71}{1000}$

O.K.



The space required between magnet and armature is .228 while the calculation was on a basis of .275. This will add 6% to E.M.F. efficiency which is 4% more than the decrease due to shortening length of cutting wire.

Clarke June 25. 1881.

On page three the product of current by turns of wire on magnet must be 4700.

The polar surface exposed to the cutting wire on the armature is in this case one half what it is in the medium machine ($\frac{17}{20}$ thus) and if we use wrought-iron cores, the free magnetism varies as the $\sqrt{\ }$ of the diameter or length therefore $\propto \sqrt{\frac{1}{2}}$.

The medium dynamo has 6" diam. 36" length. Let x be the product of diam. and length of core needed which will give half the free magnetism.

$$2 : \sqrt{72} :: 1 : \sqrt{x}$$

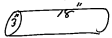
$$2 : \sqrt{6 \times 36} :: 1 : \sqrt{x}$$

$$\sqrt{x} = \frac{\sqrt{216}}{2}$$

$$x = \frac{216}{4}$$

$$x = 54$$

Two convenient factors are 3 and 18



and magnetizing power = 4700

If made of cast iron the value of free magnetism is but $\frac{2}{3}$ that for wrought iron for same magnetizing power.

This being the case there must be an increase of 50% for a motor of cast-iron.

We have then the proportion

$$2 : \sqrt{27} :: 1.5 : \sqrt{x}$$

$$\sqrt{x} = \frac{1.5\sqrt{216}}{2}$$

$$x = \frac{486}{4}$$

$$x = 121.5$$

Two convenient factors are 4.5" X 27".

If we add 25% to the magnetism we should have

$$2 : \sqrt{27} :: 1.875 : \sqrt{x}$$

$$x = 189$$

Two convenient factors are 6" x 31"

6" diam. of core gives
1.5 ft length of one turn.

If No. 20 B.W.G $\frac{31}{1000}$" diam.
it takes 118.5 feet to the ohm
Therefore 79 turns
With 90 ohms resistance there
will be 7110 product
and with 100 volts a current
of 1.1 webers and magnetizing
power of 7821 ~~[illegible]~~.

$$\text{Foot-lbs.} = \frac{100^2 \times 44.3}{90}$$
$$= 5000 \text{ ft. lbs.}$$

Weight of 90 ohms of wire
$= 39.5$ lbs.

Clarke Aug 2. 1881.

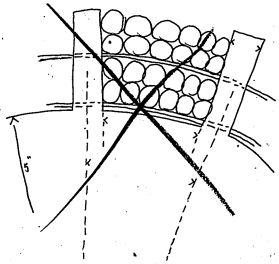
If wire .19 - $\frac{92}{1000}$" is taken
there are 170.7 feet per ohm
and 113 turns

With 90 ohms the product
will be 10170 and
magnetizing power
= 1.1 × 10170
= 11187.

Foot-lbs. with 100 volts.
$\frac{100^2 \times 44.3}{90}$ = 5000.

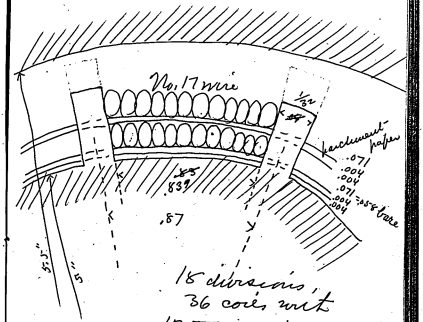
Weight of 90 ohms of this wire
= 82 lbs.

For testing the 3 H.P. motor it is decided to wind ~~it with~~ the armature with No. 19 wire.



Clarke Aug 4, 1881.

O.K.


No. 17 wire
1/32
.85
.839
.87
x
y
Insulation paper
.004
.004
.004

Menlo Park Notebook #227 [N-81-03-24]

This notebook covers the period March-October 1881. All of the entries are by Charles L. Clarke. The book contains notes and drawings of the armature for the dynamo at 65 5th Avenue, New York City and notes and calculations relating to experiments on underground conductors for the Pearl Street station. The label on the front cover is marked "Armature Wires" and is stamped "Charles L. Clarke." The book contains 278 numbered pages.

Blank pages not filmed: 16-278.

×E-172 N-81-03-24

March 24. 1881 1

Rewinding of armature for small cast-iron dynamo - for 65-5th Arc.

Formerly wound with 37 strands and 20 turns of No. 24 wire in each strand and blue resistance of 5.2 ohms.

With insulation the diam. of wire is $\frac{34}{1000}$.

If 4 turns of $\frac{42}{1000}$ are used and x is the resistance we have $\frac{20}{22^2} \times 5.2 = \frac{4}{42^2} \times x$

$\therefore x = .35$ ohm.

If 14 lb. of No. 14 wire are put on the magnets the resis. will be 1.4 ohms.

2 fields	3 ohms
1 "	1.4 "
1 armature	.35 "
	4.75

Mr. Upton states that with 6 turns at 1600 revs. it gave 60 volts with wrought iron, cast iron is $\frac{2}{3}$ the value, therefore with cast iron at 2500 revs. and 4 turns we have

42 volts on 4.75 ohms

or 8.8 volts on 1 ohm.

13.2 volts on 1½ ohms of each magnet.

Feeders - Energy on. Clarke, Oct. 12, 1885

Oct. 3rd an experiment was tried with one of the copper underground electric tubes at Edison Machine Works.

The current from 800 A lamps of 112 ohm resis. with 102 volts was passed through one of these tubes, each conductor having 262.951 cir. mils. cross section.

The tube was not sensibly warmed.

Resis. of lamp circuit $\frac{112}{800} = .14$ ohm.

Current $= 102 \times \frac{800}{112} = 729$ ampères

The resis. of one foot of tube would be (two feet of copper conductor)

$$R = \frac{10.33 \times 2}{262.951}$$

Therefore the energy lost in one foot of tube is $C^2R \times 44.3$

$$\overline{729}^2 \times \frac{20.66}{262951} \times 44.3$$

$$= 1850 \text{ ft. lbs.}$$

per foot of wire.

In one lamp at 10 volts H.P. there are 3300 ft. lbs.

Therefore $\frac{56}{100}$ of a lamp was lost on one foot of conductor.

The lamps in first district are to be 140 ohms, 10 per h.p. and it is intended to lose 15% on the feeders. 16000 lamps to be supplied.

To lose 15% the total equivalent lamps were be

$$\frac{100}{85} \text{ of } 16000$$

$$= 18824$$

Lost on feeders 2824 lamps

There are 20 feeders –
∴ 141 lamps on each feeder, and more, should have more than ½ lamp per foot of feeder.

With all the lamps on each feeder carries the current to supply 800 lamps.

Oct. 17. 1881.

With 16000 lamps the resi. of each feeder has been taken as .03126 ohms.

With 102.2 Volts on lamps the total E.M.F. will be
$\frac{100}{85}$ of 102.2 = 120.24 Volts.

With 102.24 volts on lamps the maximum loss of energy in regulating resistance (when half the lamps are on) will be

$$= \overline{120.24}^2 \times .75^2 \times \frac{.03126 \times 44.3}{(.03126 \times 2)^2}$$

$$= 115\text{-}200 \text{ ft. lb.}$$

See page 9. There should be not more than 1/2 lamp per foot lost in a feeder. Feeders a and b are respectively 767 and 295 feet long. For these will be substituted (110372 + 194968 cu. miles) the regular No. 3 of 262951 cu. miles

The resis. of the shortest wire be

$$R = \frac{10.33 \times 334}{262951}$$

$$= .01312$$

The max. energy lost in regulating resis.

$$= \frac{14407}{4 \times .01312}$$

$$= 274500 \text{ ft. lb.}$$

The resis. of next size wire is

$$R = \frac{10.33 \times 590}{262951}$$

$$.02318$$

and energy lost in regulating resis. =

$$\frac{14407}{4 \times .02318}$$

$$= 155400 \text{ ft. lb.}$$

Clarke, Oct. 27, 1885

The following are the resistances required to be successively in circuit with lamps so that they shall never be more than 105 volts or less than 102 volts.

27 ohms	1. ohm
22	.83
18	.69
15	.57
12	.47
10	.39
8	.32
6.6	.27
5.4	.22
4.5	.18
3.7	.15
3.	.125
2.5	.104
2.1	.086
1.7	.071
1.4	.059
1.2	.048
	.039
	.032

Menlo Park Notebook #228 [N-81-08-30]

This notebook covers the period August-October 1881. The entries are by Francis Jehl and consist of notes and calculations relating to meter experiments. There are two labels on the front cover marked "Meters" and "Edison Machine Works Francis Jehl." The book contains 280 numbered pages. Pages 260-275 contain skeleton tables that were never filled in. They have not been filmed.

Blank pages not filmed: 278-279.

LIBRARY OF THE

BOARD OF PATENT CONTROL,

120 BROADWAY, NEW YORK.

From Library
~~GENERAL ELECTRIC.~~
44 Broad St. N.Y.

May 1, 1896

Meter Experiments,

August 30 1881

Tested the resistence of the shunts of two meters with the following results

Number 1

Resistence of long shunt .0112 ohm
" " short " .0028 "
" " both " .014 "

Number 2:

Resistence of long shunt .0114 ohm
" " short shunt .0029 "
" " both shunts .0143 "

August 31 1881 *

I connected the two meters in series, and passed a ten Ballard cells in multiple arc and obtained the electromotive force from each shunt

One standard cell gave a deflection of 346 - 343, = 1.079 volt
#1 long shunt 51-52 = .1612036 volt
#1 both shunts 65-64 = .2019888 volt
#2 long shunt 58-53.5 = .1667055 volt
#2 both shunts 66-66 = .2062048 volt

Deflection of 1 standard cell = 345-343
#1 short shunt 13.5-11.5 = .0391677 volt
#2 short shunt 12-14 = .0406789 volt

Calculated current through each,
#1 long shunt = 14.392 veber
#1 short shunt = 13.985 veber
#1 both shunt = 14.427 veber
#2 long shunt = 14.623 veber
#2 short shunt = 14.000 veber
#2 both shunts = 14.412 veber

3.2 ohms

September 1st

a Deposition Cell, plates separated by $\frac{110}{1000}$ of an inch, and the deflection when put on the high resistance galvanometer, with no intervening resistance, is 90. Standard Battery, when short-circuited on 10.000 ohms, and the galvanometer shunted on 50 ohms gives a deflection of 90. ~~1.79 ohms~~ 1.079

September 1st

I put 100 cu. cm. of solution of sulphate of copper in 5 bottles.

To #1 added 5 drops of sulphuric acid, #2 10 drops, #3 15 drops, #4 no acid and #5 3 drops

September 2nd 1887

Tested the resistence of the wire spools. The resistence varied from 3. to 3.22 ohms at 85° Fahr. which is too low.

Had them wound over again with more wire and adjusted the resistence to 3.33 ohms each which equals 3 ohms at zero C.

Attached each coil to a bottle of standard solution and found the resistence about 4.0 ohms.

Added 5 drops of sulphuric acid to each which brought the resistence down to about 4.04 ohm.

Sept 2nd 1881

I weighed the eight coppers belonging to the meters in air and in water with following result

#1	in air	71.871175	in water	63.8879
#2	in air	80.956	"	" 71.912
#3	" "	80.7166	"	" 71.7124
#4	" "	78.1344	"	" 69.3972
#5	" "	79.4445	"	" 70.55995
#6	" "	77.2377	"	" 68.6201
#7	" "	76.9668	"	" 68.384[illegible]25
#8	" "	75.9124	"	" 67.4513

temperature of water 83° F.

From the above I calculated the specific gravity as follows.

#1	Specific Gravity	8.96
#2	" "	8.95
#3	" "	8.96
#4	" "	8.94
#5	" "	8.94
#6	" "	8.96
#7	" "	8.96
#8	" "	8.97

Sept 2

Put the bottles in the meters as follows

#1 meter.

Monthly bottle coppers # 6 + 4.
Yearly bottle " # 3 + 5.

#2 meter.

Monthly bottle coppers # 7 + 2.
Yearly bottle " # 1 + 8.

Put the meters in series and passed a current through them from ten Gallenkamp cells connected in multiple arc.

Started at 6.58 o'clock P.M.

Disconnected the meters at 12.58 P.M. Sept 3. having been connected 18 hours.

Sept 3d.

Took out the coppers and weighed them in air and water

#1 Meter

Monthly box # 6 & 4 coppers

#6 in water 68.62445 in air 77.2507

#4 " " 69.29355 " " 78.0447

very poor deposit.

Yearly Box, # 3 & 5 coppers.

#3 in water 71.67515 in air 80.718

#5 " " 70.53055 " " 79.4395

#2 Meter

Monthly box # 7 & 2 coppers.

#7 in water 68.482575 in air 77.1225

#2 " " 71.7956 " " 80.780

Yearly box # 1 & 8 coppers

#1 in water 63.81385 in air 71.8786

#8 " " 67.39805 " " 75.9074.

Sept 3 1887

Before removing the meters I obtained the electromotive-force.

1 Standard cell def 336 – 328

#1 Meter def 69 – 67 = .2242162 volts

#2 " " 65 – 67 = .2177422 "

Both " " 141 – 144 = .4634305 "

Calculated resistance of #1 meter .01395

" " of #2 .01425

" total " .00244

.03064

Calculated current #1 meter 15.20 volts

" " #2 " 14.46 "

" " both " 15.12 "

#1 Meter

Part of current through

monthly bottle .00276

yearly " .00069

#2 Meter

monthly bottle .00281

yearly " .00071

a current of 1 volt will deposit ~~1.1320.00~~ 173.6 mg per hour.

Sept 8d 1881

Set the meters in circuit again at 6.55 P.M. with the coppers reversed thus.

#1 Meter

Monthly bottle coppers # 4 & 6
Yearly bottle " # 5 & 3

#2 Meter

Monthly bottle coppers # 2 & 7
Yearly bottle " # 8 & 1

The deposit obtained in the eighteen hours was as follows, calculated.

Deposit on #6. 13 mg } 820.58 mg
Taken from #4. 87.7 " }
Deposited on #3. 1.4 " } 205.14 "
Taken on #5. 4.0 " }
Deposited on #7. 55.7 " } 735.44 "
Taken from #2. 176 " }
Deposited on #1. 1.425 " } 211.08 "
Taken from #6. 5.0 " }

Sept 5 1881

Disconnected meters at 9.25 A.M. having been connected 38½ hours.

Coppers weighed as follows.

#1 Meter

Monthly bottle

#4 in water 69.49035 in air 78.13085
#6 " " 68.37895 " " 77.0136

#2 Meter

Monthly bottle

#2 in water 71.92255 in air 80.9755
#7 " " 68.29445 " " 76.91445

#1 Meter

Yearly bottle

#5 in water 70.53055 in air 79.43935
#3 " " 71.6686 " " 80.711925

#2 Meter

Yearly bottle

#8 in water 67.3971 in air 75.9067
#1 " " 63.8058 " " 71.8639

Copper #1 having a poor thread on substituted for it another weighing in water 66.622175 in air 74.98555 before putting in the circuit again.

Sept 5 1881

The difference in weight of the coppers is as follows,

Deposited on #4, 86.15 mg. } Calculated
Taken from #6, 237.1 " } 1870.58604 mg.
Deposited on #2, 195.5 " } 1904.48874 mg.
Taken from #7, 208.05 " }
Taken from #8, .7 mg. }
" " #1, 8.7 " } 481.20534 mg.
" " #5, .15 " }
" " #3, 7.0 " } 467.65026 mg.

Put the meters in circuit again at 4.35 o'clock P.M. connected as follows

#1 Meter

Monthly bottle 6 & 4.
Yearly bottle 8 & 5.

#2 Meter

Monthly bottle 7 & 2
Yearly bottle 1 (new) & 8.

Disconnected meters at 8.35 A.M. Sept 6, having been on 16 hours

Sept 6th 1881

The coppers weighed as follows.

#1 Meter

Monthly bottle
#6 in air 77.12745 in water 68.4842 mg
#4 " " 78.0054 " 69.262675 "

Yearly bottle
#3 in air 80.707825 in water 71.66925
#5 " " 79.43385 " " 70.5808

#2 Meter

Monthly bottle
#7 in air 77.02955 in water 68.41855
#2 " water 71.77795 " air 80.80715

Yearly bottle
#1 in air 75.0205 in water 66.61555
#8 " " 75.8955 " " 67.38885

Deposit on #6, 113.85 mg } calculated
Taken from #4, 125.45 " } 777.39264 mg.
Deposit on #3, 4.1 " } 194.34816 "
Taken from #5, 5.5 "
Deposit on #7, 115.1 " } 781.47584 "
Taken from #2, 168.35 "
Deposited on #1, 34.65 " } 199.98144 "
Taken from #8, 11.2 "

Sept 6th 1881

Connected the meters again at 2.25 P. M. as follows

#1 Meter

Monthly bottle coppers 4 & 6.
Yearly bottle " 5 & 3.

#2 Meter.

Monthly bottle coppers 2 & 7
Yearly bottle " 8 & 1.

Sept 7 1881

Disconnected meters at 8.25 A.M. having been on 18 hours.

Coppers weighed as follows,

#1 Meter

Monthly bottle #4 & 6

#4 in air 78.1255 in water 69.377775 @ 80°
#6 in air 76.99915 " " 68.3686 "

Yearly bottle

#5 in air 79.4834 in water 70.58305 "
#3 in air 80.7015 " " 71.66905 "

#2 Meter

Monthly bottle

#2 in air 80.92055 in water 71.87925 "
#7 " " 76.875475 " " 68.2765 "

Yearly bottle

#8 in air 75.89115 " " 67.3892 "
#1 " " 75.87225 " " 66.816.6 "

Deposits were as follows

Deposited on #4	120.1 mg.	calculated,
Taken off #6	134.3 "	820.58 mg.
Deposited on #2	113.4 "	
Taken off #7	153.075 "	735.44 "
" " #5	0.45 "	
" " #3	6.325 "	805.14 "
" " #8	4.35 "	
" " #1	3.275 "	811.08 "

Sept 7 1887

I filled the bottles with standard solution of sulphate of copper without any acid, and connected them with small Gallard bells in multiple arc, at 4.25 P.M.

I previously cleaned coppers #4 & 6 in dilute nitric acid, they then weighed
#4 in air 78.1055 in water 69.3762 mg
#6 " " 76.9704 " " 68.3438 "

Coppers were arranged thus

#1 Meter
Monthly bottle coppers 6 & 4,
Yearly bottle " 3 & 5.
#2 Meter
Monthly bottle coppers 7 & 2
Yearly bottle " 1 & 8.

I took 5 pieces of copper and deposited upon them from 5 other pieces with the current from the dynamo in the morning continued at with two bunsen cells.

Sept 8 1887

Disconnected meter at 9.25 A.M., having been on 17 hours.
The coppers weighed as follows in water D.880 Reg.

#1 Meter.
Monthly bottle
#4. 69.3692 grams.
#6. 68.3288 "
Yearly bottle
#5. 70.5304 grams.
#3. 71.6635 "
#2 Meter.
Monthly bottle
#7. 68.2595 grams.
#2. 71.858825 "
Yearly bottle
#1 66.619,175 "
#8 67.384,6 "

Sept 8 1881

The deposits were as follows

#6 Taken off #6. 19.5 mg
Taken off #2. 20.425 "
Taken off #4. 7 mg
Taken off #7. 17 mg
Taken off #5. 2.65 mg
~~Taken off~~ #1. 2.575 mg
Taken off #3. 5.55 mg
Taken off #8. 4.6 "

Took four bottles of standard solution and put meter plates from one cell and passed a current thru them connected in series.

Copper in bottle #1 weighed in water 71,858.825 mg × 68,259.5 mg.

bottle #2
66,619.175 mg × 67,984.6 mg.

bottle #3
69,869.2 mg × 68,323.8 mg.

bottle #4
71,663.5 mg × 70,530.4 mg.

Sept 8 1881

Weighed copper as follows.

#1 Bottle
72,936.5 × 67,181.7 mg

#2 Bottle
68,463.6 × 65,545.825 mg

#3 Bottle
69,407.4 × 68,280.45 mg

#4 Bottle
71,612.95 × 70,721.7 mg

The difference in weight was

#1 { 1.07675 Deposit
1.0778 Dissolved

#2 { 1.078 Deposit
1.07885 Dissolved

#3 { 1.0836 Deposit
1.08875 Dissolve

#4 { 1.08255 Deposit
.9418 Dissolve

Added 2 drops of dilute sulphuric acid (1 to 5) to each bottle and connected again at 5.10 P.M.

Sept 8th 1881

Disconnected at 8.05 P.M.,
having been on 2 hour & 55 minutes.
The copper weighed as follows
#1 bottle

68,880 + 71,6679
~~#2 bottle~~
66,7446 + 67,19455
#3 bottle

69,475425 + 68,10625
#4 bottle

71,790025 + 70,8612
The deposits were as follows

#1 { 1,1983 Deposit
1,2686 Dissolved

#2 { 1,199135 Deposit
1,26905 Dissolved

#3 { 1,194975 Dissolved
1,30115 Deposit

#4 { 1,068325 Deposit
1,25175 Dissolved

Sept 9. 1881

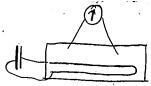
I gilded the connections of two bottles, and passed a current of 1 Ballard cell through them, starting at 10.50 A.M.,
The copper weighed as follows
#1 bottle

66,67305 + 67,07835 grams
#2 bottle

67,9489 + 69,32695
~~#3 bottle~~

22 September 9 — 1881

I took a standard Daniel Cell and connected it in circuit with 10000 Ohms, and then shifted the Thompsons high resistance Galvanometer without any resistance in at the following resistances which gave the following results.



Det	on	5	Ohms	9.
"	"	10	"	18
"	"	20	"	80
"	"	50	"	965

10000
50
(200) 1.079 [965]95

1775
3550
332

96) 0.0539500000 [0000561979] (5
480 — 96
575 — 5371874
576 — 5057811
190 — 5379984
96
940
864
760
672
880
864

Corrected

22 September 9 — 1881

I took a [illegible]

Cel

Dif on 5 Chms 9°
" " 10 " 18
" " 20 " 35
" " 50 " 96,5

10000
50
(200) 1,079 [illegible]

1715 336
3420

23

A deflection without any resistance through the galvanometer of 96 = ,005395 volts

96),005395000(,00005 5156
480
X 495 X error
480
150
96
540
480
600
576

One division equals ~~,000005156~~ ,0000561 98 of a Volt.

Deflection from a Copper Deposition Cell.—

No current ever having passed through the cell when put on direct to the galvanometer showed 14 divisions and this x by the above constant gives the Electromotive force.

,00005 6198
14

224792
56198
,0007 86772

~~,0000 551 4~~
~~224 824~~
~~55 4~~
~~,0007 72 4~~

Then I set up the same deposition cell so as to pass a current through it.

With current on the cell and then cut off and put on the galvanometer gave a deflection of 150 which was quite steady. The above cell had the current on only about ½ minute.

~~,00065 51 516 / 150 = 27 7780 0 / 55156 / ,0082780 0~~

,0000056198
150
28097 00
56198
,00842970 0

A current after being on about 1½ hours the deflection was 310 and from that it went down to 160, the first deflection is = to

~~0000 55 1516 / 310 = 1560 / 1558 / ,01 0078760~~

,0000056198
310
1685594
,01742 1386

The second – 160 – which seemed to remain constant is = to

~~,00085 51516 / 160 = 33 1360 / 55156 / ,0082 47760~~

,0000056198
160
33 71680
56198
,0089991680

I then took the deposition cell and shook it and bobbed the plate up and down several times and it gave a dif of 73 which in voltic is equal

~~00065 51516 / 73~~

,0000056198
73
16859 4
393286
,0041014 54

I then put one drop of H_2SO_4 into the solution of Copper Sulph and stirred it in. The deflection of the cell before any current was passed in was 85

~~0000 55 1516 / 85~~

,0000056198
85
28097 1
449584
,0047 7168 30

Then I put the current on for 3 min.
Then the diff first was 325
and it remained constant at 120

~~0000056198~~
~~325~~

,0000056198
325

2809990
1123996
1685994

,0182647350

,0000056198
120

,0067435760

Then put into the cell another drop of $Na_2S_2O_3$. — Then the diff before the current was put on was 91

,0000056198
91

,0050057820

Then I put the current on again for three minutes. The deflection remained constant at 120

0000056198
120

,0067435760

Then I added two drops $Na_2S_2O_3$ (making in all four drops and shook the solution up with the stirrer.
The diff then before current was put on was 91

,0000056198
91

56198
0050057820

,0051148018

Then put on the current for three minutes. The first diff then was 300 running down to 140

0000056198
300

,0168859400

,0000056198
140

2248920
56198

,0078677720

I then added 4 drops H_2SO_4 (making 8) The def then before putting current on was 200.

~~Then put~~

```
,0000056198
        200
----------
,011239600
```

Then put current on for three minutes and the def obtained was 240

```
,0000056198
        240
----------
  224792
 112396
,013487520
```

Then put the current on for ten minutes and the def was 205

```
,0000056198
        205
----------
  280990
 112396
,011520590
```


I then added four more drops H_2SO_4 (making 12) and the def before the current was put on was 2.65.

```
,0000056198
        265
----------
  280990
 337188
 112396
,014897470
```

Then I put on the current for five minutes and the def was 231.

```
,0000056198
        231
----------
   56198
  168594
  112396
,012981738
```

I then put in four more drops acid (making 16) and stirred the solution

The deflection was 245 before current was put on.

```
,0000056198
        245
----------
  280990
  224792
  112396
,013716850
```

Then put on the current for five minutes and the def was 205

(over)

```
 ,00000 56198
          206
 ----------------
      280990
     112396
 ,0116520590
```

I then reclaned the plate with $N_2 N_2 O_5$ and replaced them with the addition of 4 drops $N_2 S O_4$, (Making 20) The def then before current was put on was 132,

~~Then~~

```
 ,00000 56198
          132
 ----------------
     112396
    168594
     56198
 ,0074418136
```

I then put on the current for five minutes and def = 115

```
 00000 56198
          115
 ----------------
     280990
     56198
    56198
 ,0064462770
```

I then added 10 drops $N_2 S O_4$ (making 30) and the def = 46

```
 ,00000 56198
           46
 ----------------
     337188
    224792
 ,0025851108
```


Then put the current on for five minutes and the def = 105

```
 ,00000 56198
          105
 ----------------
     280990
     56198
 ,0059058790
```

Put in five more drops $N_2 S O_4$ (making 40) and the def without current was 80

```
 ,00000 56198
           80
 ----------------
 ,0044958840
```

Put the current on for one-half minute and the def = 110

```
 ,00000 56198
          110
 ----------------
     561980
    56198
 ,0061781780
```

Put in ten more drops (making 50) and the def before current was put = 95

```
 ,00000 56198
           95
 ----------------
     280990
     505782
 ,0053338910
```

Put the current on for one half minute and def = 120

```
,00000 56198
          120
 ----------
,00674 37760
```

Added 20 drops KI_2 & O_{H_2} (makes 70) and the def before current was put on = 110

```
,00000 56198
          110
 ----------
      561980
      56198
 ----------
,00618 17780
```

Put current on for one minute and def = 115

```
,00000 56198
         115
 ----------
      281990
      56198
      56198
 ----------
,00646 27770
```


Added 30 drops acid making 100 — and def before current was put on was 126.

```
,00000 56198
          126
 ----------
      337188
     112396
      56198
 ----------
,00708 09948
```

Put on current for 15 minutes and def = 106

```
,00000 56198
          106
 ----------
      337188
      56198
 ----------
,00595 56988
```

Put in 100 more drops acid (making 200) and def before current put on = 106

```
,00000 56198
          106
 ----------
,00595 56988 volts
```

Put current on three minutes and def = 110

```
.0000056198
        110
-----------
  5611980
  56198
-----------
.006181780 volt
```

Put in 300 drops acid (making 500) and def before current was put on = 95

```
.0000056198
         95
-----------
   280990
  505782
-----------
.005338810 volt
```

Put on current for 8 minutes and def = 105

```
.0000056198
        105
-----------
   280990
  56198
-----------
.0059000790 volt
```

Continued page 36

Sept 9th 1881

I trimmed the connection of two bottles and passed a current from 1 cell through them at 5.55 and disconnected them at 8.30 having been on 2 hour and 35 minutes.

The copper weighed before connecting

Bottle #3

72.99955 + 66.8512 grams

Bottle #4

71.754175 + 70.3022 "

Afterwards they weighed

Bottle #3

71.8857 + 67.9524 grams

Bottle #4

70.6133 + 71.4035 "

The difference was

1.11385 Taken off } #3
1.1012 Deposit }

1.140875 Taken off } #4
1.1013 Deposit }

I connected them again at 9.15 P.M.

from page 34

Sept 10 — 1881

The deposition cell was allowed to stand over night with no current on and gave a def of 49.

```
0000 56198
       49
 505982
 224792
2753702
```

With 4 Ohms resistance The current was then put on for 40 minutes and def was 115

```
0000 56198
       115
 280990
  56198
  56198
10064627 0
```

Now I changed the solution I had been using which was the ordinary — containing iron — to the standard solution of pure Copper sulphate containing no acid.

The def before current was put on was 124

```
0000 56198
       124
 224792
 112396
 56198
 56198
 6968552 Volts
```

I put current on for one minute def 135

```
0000 56198
       135
 280990
 168594
  56198
 7586730 Volts
```

Then added 10 drops acid def before current was put on 120

```
0000 56198
       120
10067437 60 — Volts
```

Put on current for 1 minute
def 135

```
.00005 6198
       135
  280990
 168594
 56198
.00758 6730 — Volts
```

Added 10 drops (making 20)
def before current was put on
120

```
.00005 6198
       120
.00678 3760 — Volts
```

Put on current for 1 minute
def 135

```
.00005 6198
       135
.00758 6730 — Volts
```


Put on current for one
minute and def 140

```
.00005 6198
       140
 2247920
 56198
.00786 7720 — Volts
```

```
.00005 6198
       140
 2607920
 56198
.00912 7720
```

Now I took out the four
Ohms resistance and add 20
drops acid (40) def before current
was put on 120

```
.00005 6198
       120
.00674 3760 — Volts
```

Put current on for 1 minute
def 140

```
.00005 6198
       140
.00786 7720 — Volts
```

Added 60 drops acid (1.09) and def before current was put on 120

.000056198
120.0
.006743760 – Volts

Put current on for 1 minute def 140

.000056198
140
.007867720 Volts

Added 100 drops acid (2.00) def before current was put on 120

.000056198
120
.006743760 Volts

Put on current for 15 minutes def 115

.000056198
115
.006462770 Volts

To this solution I added 25 drops of ammonia. def with no current 105

000056198
105
270990
56198
.005900790 Volts

Put on the current for one minute – def 130

.000056198
130
16859740
56198
.007305740 Volts

Added 200 drops ammonia
def with no current 103

.0000 56198
103
168594
5698
~~578394~~

168594
56198
5788394-0

Put current on one minute def 115

.0000 56198
115
.00646 2770 - Volts

Made the solution strongly
alkali def - no current 135

.0000 56198
135
.0075 86730 - Volts

Put current on for ~~55~~ 40 minutes
electromotive very strong - thrown
the spot off the scale.

Sept 10

Experiment to determine in ~~what~~ acid solution of
Copper Sulphate in which is
immersed two copper plates
what effect it has on the
plates. Experiment commenced
2:15 P.M.

Plates weighed

1 Without screw 63.706975

1 With screw 67.9117

Continued from 43

Spot on scale after about ten minutes (See top previous page) returned to 195.

Sept 10 1881

I disconnected bottles #3 & 4 after being connected for 1½ hours.

The copper in bottle #3 weighed
73.2217 grams
66.40065 "

The copper in bottle #4 weighed
71.98675 grams
69.98425 "

Deposit in #3 bottle 1.336 gm
Dissolved " #3 " 1.65175 "
Deposit " #4 " 1.37345 "
Dissolved " #4 " 1.419.25 "

I connected them again on one Ballard cell at 10.05 A.M.

Sept 10 1881

Experiment to determine the change in weight of two copper plates immersed in an acid solution of sulphate of copper (1 drop to 1 cu. cm) and short circuited outside.

Commenced at 2.30 P.M.

Plate #1 with screw weighed 65.4679
" #2 without " " 72.1052

I connected two bottles in series and passed a current from one Gallard cell through 400 ohms resistance through them, each bottle contained about 1/5 drop of sulphuric acid. Gilbert commutator

The coppers in bottle #1 weighed

67.085 grams without screw
66.670 grams with screw

The coppers in bottle #2 weighed

68.0027 grams with screw
69.2813 grams, without screw

Commenced at 11.15 A.M.

continued page 49

Sept 11 1881.

I silver plated 4 copper and put them in two bottles of silver solution and passed a current through them from one Gallanel cell and 400 ohms resistence commenced at 4.40 P.M.

The weight of the copper in bottle #1 was

+ copper with screw 63.4717 g.
− " without " 70.858825 "

The copper in bottle #2 weighed

+ copper #1 74.026 grams.
− " #2 68.4382 " "

Sept 12 1881

Disconnected bottles at 8.55 A.M. having been on 45 hours and 40 minutes (page 47)

The copper weighed

#1 Bottle

66.9888 grams with screw
66.7432 " without "

#2 Bottle

67.9018 grams with screw
69.35085 " without "

The difference in weight was as follows

#1 bottle

Deposited 73.2 mg.
Dissolved 96.2 "

#2 bottle

Deposited ~~73.2~~ 69.55 mg.
Dissolved 100.9 " "

Sept 12th 1881

experiment with gold plated copper.

I took four copper and gold plated them heavily and put them in two bottles of gold solution

The coppers weighed as follows

#4 Bottle

60.963075 g with long wire
60.6617 " " short wire

#8 Bottle

70.87685 g with long wire
68.88875 " " short wire

I passed a current from 1 Gallanel cell through them and 400 ohms resistance commenced at 8.50 P.M.

Sept 12 1881

continues from page 48

I disconnected the current at 4.30 P.M. having been on 33 hours and 50 minutes,

The coppers weighed in

Bottle #1

70.923.75 without screw
63.4117 without "

The coppers in bottle #2 weighed

74.081 gram
68.815 gram.

Sept 12 1881

The change in weight was as follows

Bottle #1

64.925 mg deposit.
60.000 " dissolved.

Bottle #2

55.7 mg deposit.
122.5 " dissolved.

Sept 12 1881

I connected the silver plated copper in series again as before with 400 ohms resistance

The copper weighed

Bottle #1

70.92375 grams. short wire
63.4117 " long wire

Bottle #2

74.0817 grams. long wire.
68.3157 " short wire.

I commenced this experiment at 5.25 P.M.

I found one of the vulcanite strips had got loose and short circuited the bottle.

Sept 18 1881

continued from page 50

I disconnected the gold plated copper at 11.25 A. M. after having been connected for

The copper weighed

Bottle #8

70.8617 grams long wire

63.8957 " short wire

Bottle #4

61.9527 grams

60.6657 grams

Sept 18 1881

The difference in weight was as follows.

Bottle #8

Dissolved 15.15 mg.

Deposit 11.95 mg.

Bottle #4

Dissolve 10.375 mg.

Deposit 4.000 mg.

Sept 13 1881

I connected two gold plated copper again to 1 ballard cell through 400 ohms resistance

The weight of the copper was

#4 Bottle

61.9527 Gram long wire.
60.6657 " short wire.

#8 Bottle

70.8617 Gram long wire
63.8957 " short wire.

I connected them at 12.25 P.M.

Sept 13 1881

I connected the silver plated strips in series and passed a current from 1 ballard cell throug them and 400 ohms resistance.

I commenced this experiment at 5.35 P.M.

The copper weighed

#1 Bottle

63.3517 Gram long wire
70.9657 " short wire

#2 Bottle

74.0653 Gram long wire.
68.3155 " short wire.

Sept 14th 1881

I connected two bottles in series to 1 Ballard cell through 400 ohms resistance. The distance between the plates was three times as far as usual and the solution contained about 3 per cent of acid

The coppers weighed as follows.

#1 Bottle with wire.

68.5127 g. with screw.
71.8407 g. without screw.

#2 Bottle

67.5452 g. with screw.
63.73595 g. without screw.

I commenced this exp. at 4 P.M.

Sept 14. 1881.

I connected 2 cells in series and passed a current of 1 Ballard cell through them and a resistance of 400 ohms

The coppers weighed as follows

Bottle #1

66.99135 gram without screw
66.7536 " with screw.

Bottle #2

67.907 gram with screw
69.1952 " without "

The solution contained about 10% of acid.

I commenced this experiment at 6.35 P.M.

Sept 15 1881

I made ~~four~~ circular plates of copper and connected them in pairs in series in a solution of sulphate of copper with about three per cent of acid.

I passed a current from one Callaud cell through them and 400 ohms resistance.

I commenced this experiment at 4.25 P.M.

Sept 15 1881

The circular copper weighed in air.

Disk #1

42.5248 gram no screw.
45.5613 " with "

Disk #2

33.9652 gram no screw
37.1126 " with screw

Sept 15 1881

Experiment with plates to determine what kind of a deposit can be obtained

I took two zinc plates and amalgamated them well. And immersed them in a neutral solution of sulphate of zinc (saturated).

I passed a current through them and 400 ohms resistance from one Gallard cell.

I commenced this at 1.30 P.M.

Sept 15 1881

Experiment with zinc plates.

I took two bottles of saturated solution of sulphate of zinc, and put two zinc plates (amalgamated) in each.

The zinc plates weighed

Bottle #1.

in air	in water ~~no current~~
85.2972 g	73.5304 g no current
86.1655 "	73.43295 " with "

Bottle #2.

86.0835 g	74.239 g no "
85.81605 "	74.0032 " with "

I commenced this experiment at 11.35 A.M.

One Gallard cell through 400 ohms resistance.

Sept 16 1881

continued from page 48.

I weighed the copper plates which weighed as follows,

#1 with screw 67.922 gram.
#2 without " 68.727 "

The difference in weight was as follows

#1 with screw 10.3 mg.
#2 without " 20.025 " } 10 times

Sept 16 1881

Experiment with zinc plates

I took two zinc plates and immersed them in a neutral saturated solution of sulphate of zinc.

The plates were amalgamated they weighed as follows

	in water	in air	
#1	75.0292 g.	87.007 g.	with screw
#2	74.1755 g.	86.044 "	no "

I close circuited the plates at 10.35 A. M.

Sept 16 1881

I connected two bottles with copper plates separated three times as far as usual, with 10 % acid.

The coppers weighed in water

Bottle #1 (with wire)

68.58775 gram with screw

71.7491 " without screw

Bottle #2

67.5923 gram with screw,

63.6962 " without " ,

I commenced this exp. at 1 P.M.

I connected to one ballard cell through 400 ohms resistance

Sept 16 1881

Experiment with zinc plates immersed in a saturated solution of sulphate of zinc and left alone to see if the weight changes.

The zincs weighed as follows,

in air in water

89.89115 g. 78.266 with screw

90.7008 g. 78.96485 without "

I commenced this exp at 8.40 P.M.

Sept 16 1881

continued from page 58.

I disconnected the bottles at 11.30 A. M.

The copper weighed as follows

#1 Bottle with wire

68.58775 g. with screw,

71.7491 g. without " .

#2 Bottle

67.5923 g. with screw.

63.6962 g. without " .

Sept 16 1881

The change in weight was as follows.

#1 Bottle.

75.05 mg deposit

91.6 " dissolved

#2 Bottle.

47.1 mg deposit.

39.75 " dissolved.

Sept 16 1881

I connected two bottles in series and passed a current from one cell through them and 400 ohms resistance. The solution was about 10% acid and the plates separated three times as far as usual.

The copper weighed

#1 Bottle (with wire)

68.58775 gram with screw

71.7491 " without "

#2 Bottle

67.5923 gr. with screw.

63.6962 " without " "

Commenced at 1 P.M.

Sept 17 1881

continued from page 46

I disconnected the copper at 2.25 P.M.

They weighed as follows

72.0433 gram. without screw

65.4873 " with screw

The difference in weight was as follows.

6.2 mg dissolved.

35.6 " deposit.

Sept 17 1881

Experiment with nickel plate.

I nickel plated 4 copper and put them in two bottles in series, containing a neutral solution of sulphate of ammonia and nickel.

I passed a current from one cell ~~through~~ them and 400 ohms resistence.

I commenced this experiment at 1.25 P.M.

Sept 17 1881

The nickel plated copper weighed as follows

Bottle #1

in air	in water	
79.7281 grams	70.7762	no current
79.6947 "	70.7355	with "

Bottle #3

in air	in water	
80.8652 g	71.33495	no current
84.739 "	75.209	with "

Sept 17 1881

continued from page 59

I discontinued the coppers at 1.15 P.M.

The plates weighed as follows.

Bottle #1

66.8977 gram with serum

66.8022 " without "

Bottle #2

69.356 gram without "

67.7202 " with "

Sept 17 1881

The change in weight was as follows.

144.1 mg deposit } #1
189.15 " dissolved }

160. mg deposit } #2
186.8 " dissolved }

Sept 17 1881

continued from page 63.

I disconnected the zinc plates at 3.40 P.M.

They weighed as follows

Bottle #1

in air	in water	
85.291 gram	73.53025	with screw
86.190 "	73.4278	without "

Bottle #2

in air	in water	
85.988 gram	74.1099	with screw
85.9575 "	74.1312	without "

The change in weight was

105.5 mg deposit } #1
107.2 " dissolved }

101.95 mg deposit } #2
106 " dissolved }

Sept 17 1887

I connected two bottles in series with zinc plates and passed a current through them and 200 ohm from 1 cell.

I commenced this at 4.15 P.M.

The zincs weighed as on preceding page.

Sept Sunday 18 1881

Zinc plating experiment

two plates put in zinc sulphate

Plate No 1

89.950 before current on

92.916 after " "

No 2

89 866.8 before current on

92.912.8 after " "

Here two deposit cell with zinc plates were made in the solution of zinc and then connected to a double cell.

I disconnected these plates at 9.15 A.M. Sept 20/81

The deposit was as follows.

#1 2.966 mg

#2 3.046 mg

Sept 19. 1881

Langa Chemistry p 292 says Zinc sulph. soluble in 2½ parts cold and also quantity of boiling water.

Took #5 bottles with 100 cc distilled water in each put in

No	1	—	40 grams	Zinc sulphate	
"	2	—	39	"	"
"	3		38	"	"
"	4		37	"	"
"	5		36	"	"

(Retort weight 50.105 gram) Left these bottles one night and in the morning warmed slightly to complete solution. Reduced to 15 Deg C. and found No. 1 held all the salt in solution.

Took six bottles put in

No. 1	42 grams	Zinc sulphate	100 cc water	
" 2	44	"	"	"
" 3	46	"	"	"
" 4	48	"	"	"
" 5	50	"	"	"
" 6	75	"	"	125 "

(Commercial Zinc sulphate and distilled water used)

Placed the salt in each of these bottles and then put in ice for ~~two~~ hours. Put in a little salt (Na Cl) with the ice. When taken out they were a little below 0°C. No six had all the salt in solution. Put back into ice to stay over night. Also #

#7 - 100 grams	Zn sulphate	125 cc water	
#8 75	"	"	100 "

Sept 21

This morning took the 8 bottles out of the ice and found #7 had all the salt in solution.

Put in six bottles 100 cc water in each.

Into #1 85 grams zinc sulphate

2	90	"	"
3	95	"	"
4	100	"	"
5	105	"	"
6	125	"	"

Put these bottles into the ice for two hours and found #6 had deposited a very small quantity of crystals - perhaps 10 m grams. All the other held all the salt in solution.

Took a small metre bottle with Zinc sulphate solution 100 parts water to 100 parts Zinc sulphate. Amalgamated Zinc plates. Reduced the temperature to

Sept 19 1881

continued from page 61

I disconnected the circular plates at 10.15 A.M.

They weighed as follows

#1

42.1895 gram no screw

45.7521 " with screw

#2

33.6166 gram no screw

37.3018 " with screw

The difference was

#1

335.3 mg ~~deposit~~ dissolved.

190.8 " deposit.

#2

348.6 mg dissolved.

189.2 " deposit.

Experiment with zinc plates.

I connected two bottles in series and passed a current from 1 cell through thin and 400 ohms resistence at 6.00 P.M.

The zincs weighed

Bottle #1

in water	in air	
78.6332 g	90.2345	no screw
78.6746 g	90.233	with "

Bottle #2.

in water	in air	
77.1623 g	88.5032 g	with screw
80.0122 g	91.800 g	without "

Sept 30 1881

Experiment with lead plates.

I took 4 lead plates and amalgamated them, and put them in two bottles in series, and passed a current from 1 cell through them and 400 ohms resistance. The plates weighed as follows.

Bottle #1

63.185 grains

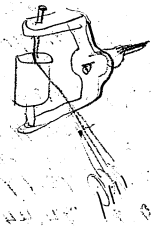
64.7867 "

Bottle #2

62.3485 grains

62.87775 "

I commenced this experiment at 3.10 P.M.



Sept 20 1881

continued from page 77

I disconnected the ~~copper~~ zincs at 2.10 P.M.

They weighed as follows

Bottle #1

in air	in water	
84.7886 g	73.0718	no screw
85.7005 g	73.8681	with screw

Bottle #2

in air	in water	
85.557 g.	73.774.2	no screw
86.340 g.	74.441.2	with "

The change in weight was

Bottle #1

408.5 mgs deposited
402.3 mg dissolved

#2

402 mg deposit
400.5 mg dissolve

Sept 21 1881

continued from page 79

I disconnected nickel plates at 9.10 A.M.

They weighed as follows

Bottle #1

in air	in water	
79.7312 g	70.777.9	no screw
79.6314 g	70.7068	with "

Bottle #3

in air	in water	
84.7155 g	75.2732 g	with screw
80.3636 g	71.3432 g	no "

The difference in weight was as follows.

3.1 mg deposit
63.8 " dissolved } #1

1.6 mg dissolved
23.5 " dissolved } #3

Sept 01 1881

I took two meters #1 & 2 and connected them in series on two Callaud cells in series. Each meter had only one bottle (monthly) which had zinc plates, amalgamated immersed in a solution of sulphate of zinc.

Sept 01 1881

The zinc plates weighed as follows,

Bottle #1

in air	in water	
90.5185 g	78.8767	with serum
90.5181 g	78.8567	no serum

Bottle #2

in air	in water	
89.8766 g	78.3282	with serum
91.3741 g	79.6182	no serum

I commenced this experiment at 2.30 P.M.

2.8

1.065
1.02
2 130
1065
1.086

1.98

~~4.32~~

9.96
11.09

from page 81

below freezing point and measured the resistance at different temperatures with the Thompson low resistance Galv. as follows (leading wires out)

32°F.	2.18 Ohms		59°F.	.97 Ohms
"	1.88		62	.96
"	1.78		63	.94
"	1.68		64	.92
32	1.58 = 1.44 at 40		65	.91
34	1.53		66	.90
35	1.52		67	.89
36	1.45		68	.88
37	1.44		69	.87
38	1.43		70	.86
39	1.45		71	.85
40	1.33		72	.84
41	1.31		73	.83
42	1.29		74	.82
43	1.28		75	.81
44	1.26		77	.80
45	1.24		79	.79
46	1.23		80	.78
47	1.21		82	.77
48	1.18 (42)		83	.76
49	1.15		84	.75
50	1.13		85	.73
51	1.11		86	.71
52	1.10		88	.70
53	1.08		89	.69
54	1.05		90	.68
55	1.03		91	.66
56	1.02		92	.65
57	1.00		93	.65
58	.98			

Plates 1/4 inch apart

94°F.	.64 Ohms
95	.63
97	.62
98	.60
100	.59
115	.58

Sept 22 1851

Tested the resistance of solution of sulphate of zinc in a metal bottle between plates 1/8 inch apart

at 40° F. = .66 ohm,
" 45° F. = .61 ohm,
" 47° F. = .58 ohm,
" 54° F. = .49 ohm,

Sept 22 · 1881

Experiment with cadmium sticks.

I took 4 sticks of cadmium in two bottles of sulphate of cadmium and connected them to one cell with 400 ohms resistance

I commenced this experiment at 11,50 a.m.

Sept 22 1881

The cadmium sticks weighed as follows

Bottle #1

104,4211 grams

106,7749 "

Bottle #2

99,5124 grams

102,478 grams

Sept 28 1887

I regulated the resistance of the spools of two meters to .66 ohm at 400 ~~F~~.

I connected the two meters in series to ten Ballard bells in multiple arc. The meters had zinc plates separated 1/8 inch apart.

Sept 28 1887

The zinc plates weighed as follows.

#1 Meter

Monthly Bottle

86.2884 grams with screw

85.5511 grams no screw

Yearly Bottle

85.6295 grams with screw

84.7516 grams without screw

#2 Meter

Monthly Bottle

88.6852 grams with screw

90.620 " without "

Yearly Bottle

87.2237 grams with screw

90.6756 " without "

Sept 24 1881

I adjusted the resistance of the meter spools to 1.45 ohms each at 84°

I connected two meters in series to 10 cells in multiple arc at 6.30 P.M.

The zincs were 1/4 of an inch apart.

Sept 24 1881

The zincs weighed as follows

#1 Meter

Monthly Bottle

91.8682 grams no acid

90.722 " with "

Yearly Bottle

90.1292 grams. no acid

89.873 " with "

Sept 24. 1881

#2. Meter

Monthly bottle

91.5209 grams no screw

88.4011 grams with screw

Yearly bottle

90.6161 grams no screw

90.0112 grams with "

Sept 27 1881

Experiment with zinc plates separated at different distances

I took three bottles of chemically pure sulphate of zinc and in each bottle I put a pair of zinc plates separated as follows.

#1 1/25 inch

#2 1/8 inch

#3 1/2 inch

I connected ~~the~~ bottles in series to three cells in series at 5.10 P.M.

Sept 27 1881

I filled the meter bottle with chemically pure sulphate of zinc and connected the two meters in series to 10 batteries all in multiple arc

The experiment was commenced at 3.55 P. M.

Sept 27 1881

#1 Meter

Monthly bottle

90.5396 grams. ~~with~~ sum

91.006 grams. ~~no~~ sum

Yearly bottle

88.0187 grams ~~with~~ sum

89.6963 grams no sum

Sept 27 1881

#2 Nitra

Monthly Bottle

89.9561 grams with serum

90.740 grams no serum

Yearly bottle

88.4007 grams with serum

90.154 grams no serum

Sept 28 1881

I disconnected the meters at 11.40 A.M., having been on 19¾ hours.

The solution was clear in all the bottles and the deposit was excellent.

Sept 28 1881

The zinc plates weighed

#1 Meter

Monthly bottle

91.0928 grams with screw

90.472 grams without screw

#2 Meter

Monthly bottle

90.540 grams with screw

90.183 grams without screw

Sept 28 1881

#1 Meter

Yearly bottle

~~#1~~

88.1468 grams with screw

89.5684 grams no screw

~~#2~~ Meter

Yearly bottle

90.2815 grams no screw

88.2625 grams with screw

Sept 28 1881

The difference in weight was as follows

#1 Meter

Monthly Bottle

553.2 mg. deposit
534.0 mg. dissolve

Yearly Bottle

128.1 mg deposit
127.9 mg dissolve

#2 Meter

Monthly bottle

583.9 mg deposit
587. mg dissolve

Yearly bottle

127.5 mg deposit
138.2 " dissolve

Sept 28 1881

I set the meters going again as before at 1.15 P.M.

The zincs weighed as on page 106 & 107

The plates to be deposited on were the same as had been dissolved before.

I did not amalgamate the zincs again

Sept 28 1881

I took two zinc plates separated half an inch and passed a current from 5 Gallard cells in series through them to see what kind of a deposit is obtained with a strong current

Commenced at 3.15 P. M.

Sept 28. 1881

This morning the deposit was black and loose and much at the bottom

Sept 29 1881

I disconnected the meters at 10.30 A. M.

The deposit on the plates in monthly bottles was quite loose

That in the yearly bottles was better but not very adherent so that the weight could not be obtained

September 29 1881

The plates which were dissolved from weighed as follows.

#1 Meter

Monthly bottle

90.480 grams

Yearly bottle

88.~~[illegible]~~.0046 grams

#2 Meter

Monthly bottle

89.9258 grams

90.1417 grams.

Sept 29 1881

The weight of zinc dissolved was as follows

#1 Monthly

612.8 mg

2 Hours 1.4 mg.

#2 Monthly

614.2 mg

~~#1 Monthly~~ Yearly

142.2 mg

2 Hours 2.4 mg.

#2 Yearly

139.8 mg

Sept 29 1881

continued from page 101

The deposit in all the bottles was loose and black and some of it had fallen to the bottom of the bottle

Evidently the current was too strong.

Sept 30 1881

I coated the zinc with an amalgam of mercury and zinc by contacting with zinc and then amalgamating and plating again and so on.

I set the meter going again with the zinc prepared as above.

I connected the meter at 6,00 P.M.

Sept 30 1881

The gauge weighs as follows:

#1 Meter

Monthly bottle

91.6845 grams with screw

90.8063 " without "

Yearly bottle

92.3410 grams with screw

92.8661 " without "

Sept 30 1881

#2 Meter

Monthly bottle

92.2785 grams with screw

94.0096 " without "

Yearly bottle

90.6362 grams with screw

92.8852 " without "

Oct 3d 1881

I amalgamated the cadmium sticks, and immersed in a solution of cadmic sulphate,

I connected them to one Gallard cell and 400 ohms resistance.

I commenced this experiment at 10.00 a.m.

Oct 3d 1881

The cadmium sticks weighed as follows

#1,

104.146 grams,

#2.

106.650 grams,

#3

99.2968 grams,

#4

108.4727 grams,

Oct 8 1881
continued from p. 117
I discontinued the meter at 1.56 P.M.
The deposit in the monthly bottles was not very adherent and that in the yearly bottles though better was still not very good.

Oct 8 1881
The gauges weighed as follows,
#1 Meter
Monthly bottle
91.7864 grams, no snow
90.4315 " with "
#2 Meter
Monthly bottle
94.7736 grams no snow
91.5683 " with "

Oct 6th 1881

#1 Meter

Yearly bottle

92,1601 grams with manure

93,0705 " no " "

#2 Meter

Yearly bottle

93,1012 grams no manure

90,4163 grams with "

Oct 3 1881

The difference in weight was as follows,

#1 Meter

Monthly bottle

910.1 mg Deposit

1353 mg Dissolved

#2 Meter

Monthly bottle

764 mg Deposit

708 mg Dissolved

#1 Meter

Yearly bottle

177.9 mg Deposit

184.5 mg Dissolved.

#2 Meter

Yearly bottle

216 mg Deposit

219.9 mg Dissolved

Oct 3rd 1887

I filed off the deposit and remalgamated the piece, and connected this again to the 10 cells of battery.

I commenced this experiment at 6.15 P.M.

Oct 3 1887

The zinc weighed as follows.

#1 Porter

Monthly bottle

88,6091 grams no screw

88,485 grams with screw

Yearly bottle

90,0846 grams no screw

88,7577 grams with screw.

Oct 3 1881

2 Meter

Monthly bottle

88,161 grams no sunw

89,845 grams with "

Yearly bottle

91,5218 grams no sunw

90,4139 grams with "

Oct 4th 1881

I disconnected the meters at 3.10 P.M.

The deposit was good on all the plates,

The deposit was small as the batteries were nearly run down.

Oct 4 1881

The plates weighed as follows.

#1 Meter

Monthly bottle

88.733 grams with screw

88.3161 " no screw

Yearly bottle

88.6835 grams with screw

90.3577 " no screw

Oct 4th 1881

#2 Meter

Monthly bottle

88.4765 grams no screw

89.5411 " with screw

Yearly bottle

91.6025 grams, no screw

90.353 " with screw

Oct 4th 1881

The change in weight was as follows,

#1 Meter

Monthly bottle
308. mg Deposit.
293 mg Dissolved.

Yearly bottle
73.1 mg Deposit.
74.2 mg Dissolved.

#2 Meter

Monthly bottle
315.5 mg Deposit.
303.9 mg Dissolved.

Yearly bottle
70.7 mg Deposit.
60.9 mg Dissolved.

Oct 4th 1881

I connected the meter again the same as before.

The bottom being almost worn down I put in more blue vitriol.

I commenced this experiment at 4.35 P.M.

For weights see pages 129 + 130.

Oct 6th 1881

continued from page 119.

Disconnected the cadmium at 4.30 P.M.

They weighed as follows.

#1

103.909.1 grams.

#2

106.945 grams.

#3

99.020 grams.

#4

103.7649 grams.

Oct 6th 1881

The difference was as follows.

#1.

236.9 mg. Dissolve

#2.

~~106.~~

295 mg Deposit

#3.

276.8 mg Dissolve

#4

292.2 mg Deposit.

Oct 8th 1881.

I connected the cadmium plates again at 6 00 P.M., quickly the same as before

Oct 8th 1881

continued from page 134

I disconnected the ~~zinc~~ cadmium plates at 11 00 A.M.

They weighed as follows

#1

103.6425 gram

#2

107.3005 gram

#3

98.7705 gram

#4

104.1175 gram

Oct 8th 1881

The difference in weight was as follows,

#1

366.6 mg Dissolve

355.5 mg Deposit

#3

349.5 mg Dissolve

#4

352.6 mg Deposit

Oct 8th

Continued from page 65

I discontinued the zinc at 1.00 P.M. 38 days. They weighed as follows

85.945 grams no screw

86.9478 " with screw,

The difference was as follows

99 mg less

86 mg less

The plates were ~~[illegible]~~ slightly covered with a dark covering which rubbed off leaving them bright.

Oct 10th 1881

continued from page 134

I disconnected the [illegible] at 12.00 m,

The deposit in the monthly bottles was rather loose.

Oct 10th 1881

The zinc weights as follows.

#1 Meter

Monthly bottle

86.106 grams no urine

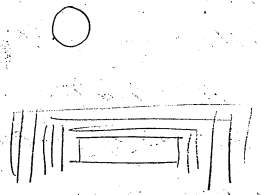
90.9174 " with "

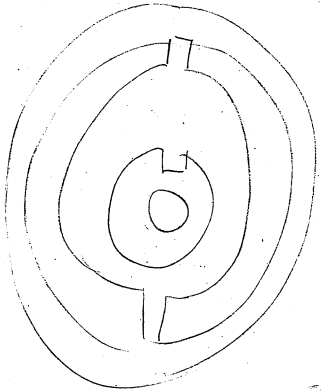
#2 Meter

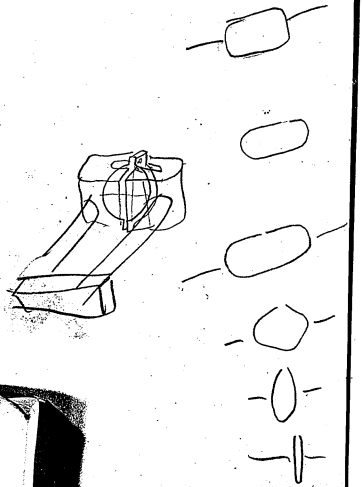
Monthly bottle

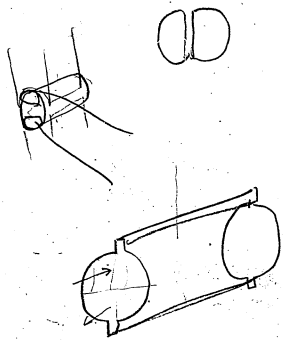
90.4406 grams no urine

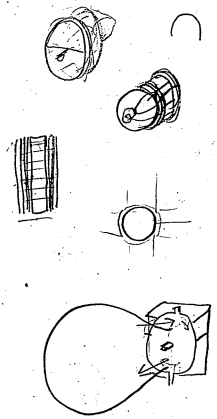
87.7784 " with "

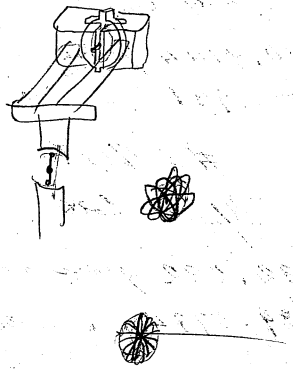












Oct 10th 1881

#1 Meter

Yearly bottle

90.9144 gram no serum

88.1931 " with serum

#2 Meter

Yearly bottle

92.282 gram no serum

89.8794 " with serum

Oct 10th 1881

The difference in weight was as follows

#1 Monthly

3.1844 gram Deposit

~~1.9641~~ " Dissolved

2.2101

#2 Monthly

1.9641 gram Deposit

1.7471 " Dissolved

#1 Yearly

556.7 mg Deposit

490.4 " Dissolved

#2 Yearly

629.5 mg Deposit

473.6 " Dissolved

Oct 10th 1881

Experiment with zinc plates immersed in S. P. sulphate of zinc and short circuited to see if the weight changes.

The zincs weighed as follows,

86.830 grams with screw

86.0461 " without "

Commenced at 8.30 P. M.

Oct 11th 1881

continued from page 67

The zincs weighed as follows

89.8561 gram with screw

90.660 " without screw

The difference was as follows

85.05 mg lost with screw

40.8 mg lost no screw

These zincs were left in for 25 days.

Oct 12th 1881

Experiment with zinc plate immersed in a solution of chemically pure sulphate of zinc and left alone to see if the weight changes.

The zinc plates weighed as follows.

90.7472 grams no screw

89.7337 grams with screw.

I commenced this experiment at 9.30 A.M.

Meter Experiments

Oct 18 1881

Made 10 shunts each having a resistance of .01078 ohms. Also 10 small shunts each having a resistance of .00269 ohms at 85°F. this is good

Also made 20 spools of copper resistance for compensating. this resistance is 3 ohms at 0°C. at about 60 it was or was measured off at 3.19 ohms.

Had some C.P solution of sulphate of zinc and put in each of the 20

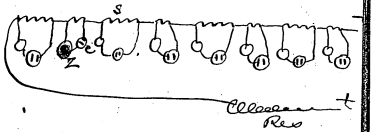
7

1.079
18
8632
1079
19.422 volts
116.2
38844
116532
19422
81.46364 volts on the res

1.675) 81.46364 (18.78
1675
14713
13400
13364
11725
14114
13400

bottles 124 C.M of the solution. This solution is of the strength 1 to 1 1 pound of sulphate of zinc to 1 pound of water.

had all these shunts arranged in series and in circuit with some resistance. like fig.



Resistance with leading wires 1.700 ohms
.025

1.675 ohms at 15°C

Put the current on at at 10.15 Oct 14 1881. on all the plates stop at 11.15 so that it ran just one hour.

315
10) deflect from the terminals of the 1.675 ohms.

191
198
2)384

192)315
810
2)625
192)612 (1.62
192
1200
1152
480

161 25 2
645 00

see page 154

Cell C

# 13		weight	
without screw		80.522,2	loaning plate lost 616.6 mg.
with screw		82.782,1	
compartment	screw	79 905.6	
with screw		83.433.7	deposition plate had a deposit of 651.6 mg.
80.522.2		83 433 7	
79 905.6		82.782 1	
616.6		651.6	

~~without screw~~ 80.00276
~~with screw~~ 88.6982
~~without screw~~
~~with screw~~

17 cell "D"

without screw 81.242,7
with screw 82.085,6
without screw 81.120
with screw 82.246,85

dissolved 122,7
deposit 161,25

81.242,7
81.120
122,7

82.246,85
82.085,6
161,25

without screw 81.2431
with screw 82.3001
without screw
with screw

16 cell "E"

without screw 80,560,7
with screw 82,446,6
without screw 79.931,5
with screw 80.111,6

dissolved 629,2 mg
deposit 667,1 mg

80.560,7
79.931,5
629,2

83.111,6
82.446,6
667,0

without screw 79.8051
with screw 80.5305
without screw
with screw

"7"

#15

without screw 81.173
with screw 81.926.2
without screw 81.05855
with screw 82077,5

dissolved
114,45 Mg
deposit
~~90~~ 151.3

81 173
81 05855
82 11 [illegible]95
82 07775
81 926.2
1.513

82 1175
81 1175
9045

without screw 80,920
with screw 81.701
without screw
with screw

#14 "G"

without screw 80,947.95
with screw 81,355
without screw 80,3332
with screw 82.0141

Dissolved
614.75
Deposit
659.1

without screw 80,0512
with screw 82,1755
without screw
with screw

12 "H"

without screw 81.223.5
with screw 82,340
without screw 81.105
with screw 82,4918

Dispersed 118.5
Deposit 151.8

without screw 80.990
with screw 82,0565
without screw
with screw

11 "J"

without screw 82.142,5
with screw 83,382.
without screw 81,5115
with screw 84.0473

Dispersed 631,
Deposit 665,3

without screw 81.5569
with screw 84,2782
without screw
with screw

#10 " J "

without screw 82.4641.3
with " screw 83.42015
without screw 82.3465
with screw 83.5711

Discharge 117.8
Deposit 150.6

~~without screw 82.3381~~
~~with screw 83.2132~~
~~without screw~~
~~with screw~~

#9 " K "

without screw 86.962.8
with " screw 88.287.8
without screw 81.338.5
with screw 83.90305

Discharge 624.3
Deposit 666.75

~~without screw 81.2374~~
~~with screw 83.9741~~
~~without screw~~
~~with screw~~

#8 "L"

without screw 82,153.9
with screw 82,950.35
without screw 82,038.35
with screw 83,1045

dissolve 120.55
deposit 154.15

~~with screw~~
~~without~~

without screw 81,5763
with screw 82,910
without screw
with screw

#7 "M"

with out screw 89,045.05
with screw 90,944.1
without screw 88,4507
with screw 91,5609

dissolve 694.35
deposit 616.8

This spool had some sulphate of zinc spilled on it

without screw 88,4968
with screw 91,6947
without screw
with screw

#6 "N"

without screw	81.779.6	Dissolve 116,05
with screw	83,260	
without screw	81,66355	Deposit 132,4
with screw	83,3924	

without screw 80,8958
with screw 83,2468
without screw
with screw

#5 "O"

without screw	82,580	Dissolve 637,8
with screw	83,17512	
without screw	81.942	Deposit 660,8
with screw	83,836	

without screw 81,961
with screw 84,0846
without screw
with screw

#4 "Q"

without screw	91.528.8	Dissolve,
with screw	89.653.2	92.2
without screw	91.4366	Deposit.
with screw	89.7434	90.2

~~without screw 89,8451~~
~~with screw 86,8476~~
~~without screw~~
~~with screw~~

#3 "Q"

without screw	82,275.	Dissolve
with screw	83,491.8	615.15
without screw	81,65985	Deposit
with screw	84,137.9	646.1

~~without screw 79,8488~~
~~with screw 83,9675~~
~~without screw~~
~~with screw~~

Took the above plates out and put the following plates in
without screw 78.513.1
with screw 89,027

I put ammonia in the zinc and plate and strong to dissolve the precipitates and put the plates in this.

#2 "R"

~~without screw~~	81.201.35	Wilmington 112.8
with screw	89.579	
~~without screw~~	81.18865	Wilpark 116.1
~~with screw~~	89.6951	
~~without screw~~	81.0971	
~~with screw~~	89.4868	
~~without screw~~		
~~with screw~~		

"Q" #1

without screw	91,497,2	Dividend 576,3
with screw	89,882,5	
without screw	90,920,9	Deficit 591,2
with screw	90,4737	

without screw 90,8165
with screw 90,2939
without screw
with screw

"T"

without screw	88,705,9	Dividend 116,9
with screw	83 675,2	
without screw	83,589	Deficit 149,3
with screw	83,8245	

without screw 83,28285
with screw 83,7179
without screw
with screw

u

without screw 82,513,2
with screw 83 335,6
without screw 81,8645
with screw 84,0133

Deviation 648,7
Deflect 677,7

~~without screw 81,9363~~
~~with screw 84,2057~~
~~without screw~~
~~with screw~~

v

without screw 78,329,15
with screw 82 195,1
without screw 78,20445
with screw 82,659

Deviation 124,7
Deflect 162,1

~~without screw 76,614~~
~~with screw 81,5075~~
~~without screw~~
~~with screw~~

see page 156

~~Oct 14 1881~~

Started again at 11:31
Stopped at 11.51

11.51
11.31
.20

Raw or rather the current worked so far for 1.20 hr

Started again 12.42
stop at 2.15
started at 2.26
stop at 5.20

60
12
18

60
32
34 18

1.20
.87
2.53
2.54
5.07

1.42
.12
1.78
.34
2.54

1.78
.66
1.44
33

get the conductivity of copper

1.20

51
11.31
20

Raw so far 5.07 mute
Started at 9.15
Stop at 12.00
9.15
2.45

5.07
2.45
7.52 hrs so far

Started at 1.10 again
Stopped at 4.30

Oct 17 1881

The change in weight was as follows on the long shunts,

Bottle,	Deposit,	Dissolved,
C.	651.6	616.6
E.	667	629.2
G.	659.1	614.75
I.	665.3	631
K.	666.75	624.3
+ M.	616.8	694.35
O.	660.8	637.8
Q.	646.1	615.15
S.	591.2	576.3
W.	677.7	648.7

+ This spool had some sulphate of zinc spilled on it,

Oct 17 1881

The change in weight was as follows on the short shunts

Bottle,	Deposit,	Dissolved,
D.	161.25	122.7
F.	151.3	114.45
H.	151.8	118.5
J.	150.6	117.8
L.	154.15	120.55
N.	132.4	116.05
P.	90.2	92.2
R.	116.1	112.8
T.	149.3	116.9
V.	162.1	124.7

Oct 16th 1887

Connected two meters in series to 10 Gallons cells in multiple arc.

The meters had electrolytic zincs.

Connected them at 4,50 P.M.

Oct 15 1887

The zincs weighed as follows,

#1 Monday

87.29376 g. no screw,

79.3707 g. with screw,

#1 Friday

95.5306 g. no screw,

77.6527 g. with screw,

Oct 16 1881

#2 Meter

Monthly bottle

86.0408 g no screw

86.2205 g with "

Yearly bottle

88.0593 g. no screw

86.9343 g. with screw

Oct 17 1881

Connected meter again at 5.45 P.M.

Started the meters C to L at 4.6 PM. oct 19 1911
the solution is the ammonium one.

80.9454
80 4952
4502

oct 19 1911 C

ammonium solution

without screw	80,945.4
with screw	81,890.7
current on	
without screw	80 495.2
with screw	
Deposit	
Dissolve	450.2

79 3186
79 2149
1037
83 792 8
83 698
948

D. am Solution

without screw	79.318,6
with screw	83 698
Current on	
without screw	79.214.9
with screw	83,792,8
Deposit	94.8
Dissolve	103.7

80.1508
79.7002
450.6

E	
without screw	80.150.8
with screw	80,803,2
current on	
without screw	79.700.2
with screw	
Deposit	
Dissolve	450.6

79 2952
79 1969
98.3

82 6295
82 5408
88.7

without screw	79.295.2
with screw	82,540.8
Current on	
without screw	79,196.9
with screw	82.629.5
Deposit	88.7
Dissolve	98.3

79.6731
79.229

444.1

without screw	79,673.1
with screw	84,209.3
current on	
without screw	79.229
with screw	84 650.
Deposit	
Dissolve	444.1

80 573.5
80 474.1
994

82 323.1
82 224
991

H	
without screw	80,573.5
with screw	82,224,
Current on	
without screw	80 474 1
with screw	82 323 1
Deposit	99.1
Dissolve	99.4

80.288.1
79835.5
4426

85002.3
84547.6
4547

J	
without screw	80,288.1
with screw	84,547.6
current on	
without screw	79835.5
with screw	85002.3
Deposit	4547
Dissolve	4421.6

82 4762
81 5953
8809

81 5953
81 4989
964

82 4762
82 380
962

without screw	81.595,3
with . . screw	82.380
Current on	
without screw	81 4989
with screw	82 4762
Deposit	96.2
Dissolve	96.4 ~~0 09~~

80 8888
80 4436
4452

K.

without screw	80.888.8
with screw	82,735,3
current on	
without screw	80 4436
with screw	
Deposit	
Dissolve	4452

80884.5
80786.8
977
84462.1
84364.9
972

L,

without screw	80,884.5
with screw	84,364.9
current on	
without screw	80,786.8
with screw	84 462.1
Deposit	97.2
Dissolve	~~75~~ 97.7

Summary

	Deposit	Dissolve
(1) "C"		450.2
(2) "D"	94.8	103.7
(3) "E"		450.6
(4) "F"	88.7	98.3
(5) "G"		444.1
(6) "H"	99.1	99.4
(7) "I"	454.7	442.6
(8) "J"	96.2	96.4
(9) "K"		445.2
(10) "L"	97.2	97.7
Remarks		

Experiment Oct 19 1881

to determine if there is any loss ~~of the~~ weight when the plates are in the solution open circuit.

without screw	76.592
with screw	81.450
Plates put in solution	
without screw	
with screw	
Loss	
Gain	

Oct 19 1881.

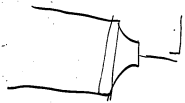
Experiment

to determine if there is any loss of ~~wa~~ weight in the plates when short circuited on itself.

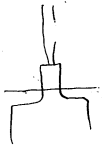
without screw	81.5459
with screw	84.8482
~~plates put in solution~~	
without screw	
with screw	
Lost	
Gain	

80 5729
80 1712
401 7

83 7066
83 3085
398 1



Without screw	80 5729
With screw	83 3085
Current on	
Without screw	80.171.2
With screw	83 706.6
Deposit	398.1
Dissolve	401.7



79.0434
78954
0894
83.5862
83.513.7
72.5

Without screw	79.0434
With screw	83.513.7
Current on	
Without screw	78954
With screw	83.5862
Deposit	~~0894~~ 72.5
Dissolve	89.4

82 4585
80 0126
4459

82 7121
82 2845
4276

C

Without screw	80.4585
With screw	82.2845
Burnt on	
Without screw	80 0126
With screw	82 7121
Deposit	4276
Dissolve	445.9

79 758 3
79 661 8
96 5
88
81 199 7
87 5

7

Without screw	79.758.3
With screw	81.111.7
Cement on	
Without screw	79 661 8
With screw	81 199.2
Deposit	87.5
Discharge	96 5

```
79 383 6
79 002 6
---------
     3810
83 030 7
82 660
---------
     3707
```


Oct 23 G

Without screw	79.383.6
With screw	82.660.
Current on	
Without screw	79.002 6
With screw	83 030 7
Deposit	370.7
Dissolve	3810

80 2545
80 1679
866

82 2682
82 1871
811

Without screw	80.2545
With screw	82.1871
Current on	
Without screw	80 1679
With screw	82 2682
Deposit	81 1
Dissolve	86 6

80 4234
79 9865
4369

85 1357
84 6927
4430

Without screw	79.986.5
With screw	85,135,7
Increase on	
Without screw	80 4234
With screw	84 6927
Dissolve	4430
Deposit	4369

Without screw	T9.253.4
With screw	X4.664.
Current on	
Without screw	
With screw	
Deposit	
Dissolve	

K

Without screw	81.370.9
With screw	82.370.1
Current on	
Without screw	
With screw	
Deposit	
Dissolve	

Without screw	80,570,8
With screw	84,451,2
Exposed on	
Without screw	
With screw	
Deposit	
Dissolve	

Summary

	deposit	dissolve
C	398.1	401.7

Oct 23

This One was shot executed on itself

without screw	80 936.7
with screw	89.081.3

79 286 1
78 798 2

4879

Oct 23, 1891 The following six all were put in circuit with one battery and alarm

S.

without screw	78,798,2
with screw	83,103,5
without screw	79 2861
with screw	82 6233
	487.9

79 3712
78 8726
4986

84 731
84 2433
4877

without screw	78,872,6
with screw	84,731,
without screw	79 3712
with screw	84 2433

80 8 905
80 399 5
4910

84 283 8
83 751 6
5022

J

(without screw	80,399.5
(with) screw	84,283.8
without screw	80 905
(with) screw	83 751 6
deposit	491.0
dissolve	502.2

80 9623
80 4695
4928

84 4435
83 9584
4851

W	
without screw	80.469.5
with screw	84.443.5
without screw	80 962.3
with screw	83 958.4
deport	4928
dissolve	485.1

80.4258
79941.4
4844

83591
83 937
49734

83591
831028
4882

~~80 4258~~
~~79 9414~~
4846

80 4357
~~799414~~
4943

R

without series	79,941,4
~~with~~ series	83,591.
without series	80 4258
with series	83 0937
deposit	494.4
discrete	488 3

```
 81283.3
 80791.3
 -------
   492.0

 84755
 84271.9
 -------
   483.1
```


without screw	80.791.3
with Screw	84 755
without screw	81 283.3
with Screw	84 271 9
deposit	492.
dissolve	483.1

```
 49
  2
 98
```

N Oct 23 1881

Without Screw	90,299 6
With Screw	90,550.
Current on	
Without Screw	90 095
With Screw	90 745 3
Deposit	195
Dissolve	204 6

90 299 6
90 95
20.4 6

90 745 3
90 550.
19 5 3

R Oct 23 1881

Without Screw	81,971.2
With Screw	82,961.9
Current on	
Without Screw	81 765
With Screw	83 1625
Deposit	206
Dissolve	206.2

81 971 2
81 765
206 2

83 1625
82 9619
206 6

U

Without Screw.	81.6812
With Screw.	84 282
Current on	
Without Screw.	81 476.9
With Screw.	84 499.7
Deposit	1977
dissolve	2043

81 6812
81 476 9
2043

84 499 7
84 282
1977

J

without screw	89,717.9
with screw	86,812,3
without screw	89 5135
with screw	87 0081
deposit	1958
dissolve	2044

89 717 9
89 5135
2044

87 0081
86 8123
1958

V

without screw	83 196 2
with screw	83 550.2
without screw	82 990 6
with screw	83 742 3
	192.1
dissolve	205.6

83 196 2
82 990 6

2056

83 742 3
83 552 2

1921

S

without screw	82 587.1
with screw	84 002.1
without screw	82 375 4
with screw	84 193.1
deposit	191
dissolve	206.7

82 587 1
82 375 4

2117

84 193 1
84 002 1

1910

82 587 1
82 380 3

2068

1.9
3.10

Oct 24 1881

N

Without screw	90.095
With screw	90.745.3
Current on	
Without screw	91 369.4
With screw	89 491.1
Deposit	1 274.4
Dissolve	1254.2

The following experiments up to "S" on page 255 which is six cell, the solution being the acetate of zinc, the cell were put in series and observed on a daniell cell and so that the direction of the current is opposite the preceeding one.

J

X

Without screw	89.513.5
With screw	87 008.1
Current on	
Without screw	90 786.8
With screw	85 753.9
Deposit	1.273.3
Dissolve	1.254.2

913694
90095
12744

907453
894911
12542

25286
25275
25295

9078668
8951335
12733

87 00081
85 75339
12542

1 mm 2527
2.5

U

Without screw	82.990.6
With screw	83 742.3
Current on	~~84 2705~~
Without screw	84 2705
With screw	82 4927
Deposit	1 279.9
Dissolve	1 249.6

84 2705
82 9906
1 2799

83 742 3
82 492 7
1 249 6

100/1 2.74 (12.74
~~274~~

1 5295

J

Without screw	81.476.9
With screw	84.479.7
Current on	
Without screw	82 7586
With screw	83 207
Deposit	1281.7
Dissolve	1272.7

82 7586
81 476 9 — 25544
1 281 7

84 479 7
83 207
1 272 7

V

Without screw	82.375.4
With screw	84 193.1
Current on	
Without screw	83 653.9
With screw	82 944.8
Deposit	1.278.5
Dissolve	1.248.3

83653.9
82375.4
1278.5

84193.1
82944.8
1248.3

1281.7 1281.7 1277
1273.3

8.4

S

Without screw	81 765
With screw	83 162.5
Current on	
Without screw	83039.8
With screw	81 906.9
Deposit	1 274.8
Dissolve	1 255.6

83039.8
81765
1274.8

83162.5
81906.9
1255.6

deposit	dissolve
1274.4	1254.2
1273.3	1254.2
1279.9	1249.6
1281.7	1272.7
1278.5	1248.3
1274.8	1255.6

1277.1 being the average

~~Lost~~ 4.6 ⅓ of 1%
~~Gain~~ 3.8 " "

Oct 25

N

Without screw	84.2705
With screw	82.4927
Current on	
Without screw	
With screw	
Deposit	
Dissolve	

U

Without screw	82.7569
With screw	83.2055
Current on	
Without screw	
With screw	
Deposit	
Dissolve	

F J

Without screw	83.6539
With screw	82.9448
Current on	
Without screw	
With screw	
Deposit	
Dissolve	

R

Without screw	83 0398
With screw	81 9069
Current on	
Without screw	
With screw	
Deposit	
Dissolve	

+2
+3

101 309
81

81) 309 (3.81
243
660
648
12

.0107
81

1.07

1.0107
3.81
.107
856
321
.040767

.5)100 (20 $\frac{1}{20}$

20

$\frac{1}{8}$ = $\frac{1}{4}$ lar

1

.03) 1000 (333
9
10
9
90

10

100)140 (

.05) 1.4 (

1 5) 140 (28
28
.05
140 4

$\frac{1}{28}$ 100 (.04
112
7
3

100 28) 270 (76
252
189
168 4

100 # 75 sifting screen

206.107.1.22

Menlo Park Notebook #229 [N-81-03-23]

This notebook contains one entry by Charles L. Clarke, dated March 23, 1881. It is titled "Magnet Wires for 5 H.P. Motor at Menlo Park" and includes notes and calculations relating to this motor. The label on the front cover is marked "Magnet Wires" and is stamped "Charles L. Clarke." The book contains 280 numbered pages.

Blank pages not filmed: 6-280.

x E-172 N-81-03-23

March 23, 1881. 1

Magnet Wires for 5 H.P. Motor at Menlo Park — on which will be 110 volts.

On the regular medium machines are 120 lbs. of No. 10 wire having a resis. of 1.47 ohms.

To economically saturate the magnet requires 5500 ft.lb. and with 110 volts the resistance in magnet circuit should be

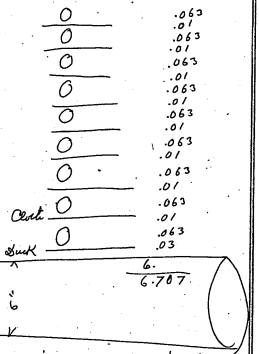
$$\frac{110^2}{x} \times 44.3 = 5500$$

$$x = 97\tfrac{1}{2} \text{ ohms resis.}$$

120 lbs. of No. 19 wire would introduce too high a resistance.

120 lbs. of No. 18 wire would have a ~~re~~ length of

1650 feet and have a resistance of 73 ohms.



The average diameter will be 6.707 inches and circumference 21.07 inches.

The number 18 wire of $\frac{48}{1000}$ will with insulation be $\frac{63}{1000}$

and since the cores are 3 ft. long 5
the no. of turns will be 572
and total length in each
layer 1004 feet – on each
core 8255 feet are required
= $8\frac{1}{4}$ turns.
But if used without cloth
between it would require
9 turns.

Menlo Park Notebook #230 [N-81-03-18]

This notebook covers the period March-June 1881. The entries are by Francis Jehl and consist of notes, calculations, and a few drawings relating to meter experiments. The label on the front cover is marked "Experimental Lamps" and "Francis Jehl." The book contains 276 numbered pages.

Blank pages not filmed: 118-275.

Missing page numbers: 1-2, 39-40.

Log of .018738 =

$\bar{2}.2727232$

Log .0659274 = $\bar{2}.8190659$

LIBRARY OF THE

BOARD OF PATENT CONTROL,

120 BROADWAY, NEW YORK.

From Library
~~GENERAL ELECTRIC.~~
#4 Broad St. N.Y.

May 1, 1896

March 18, 1881.

Meter No: 1

3/18/81 { Started 1.14 P.M. — Out at 6.03 P.M. = 89"
" 7.05 " — " " 8.25 " (80")
" 8.44 A.M — " " 10.50 A.M (126")
3/19/81 { " 10.57 " — " " 12.02 P.M. (65")
" 1.10 P.M — " " 5.02 " (232")

792"

9)100
120

10/100
10

10
100
9
1.

9)100.
11.1

10

March 18, 1881.

Meter No. 2

3/18/81.	Started 1.15 P.M.	— Out at 6.03 P.M.		(288")
	" 7.05 "	— "	" 8.25 "	(80")
	" 8.43 A.M.	— "	" 10.50 A.M.	(127")
3/19/81.	" 10.57 "	— "	" 12.02 P.M.	(65")
	" 1.11 P.M.	— "	" 5.02 "	(231")
				797"

March 18, 1881.

Meter No. 3

3/18/81.	Started 1.15 P.M.	— Out at 6.03 P.M.		(288")
	" 7.05 "	— "	" 8.25 "	(80")
	" 8.42 A.M.	— "	" 10.50 A.M.	(128")
3/19/81.	" 10.57 "	— "	" 12.02 P.M.	(65")
	" 1.11 P.M.	— "	" 5.02 "	(231")
				792"

March 18, 1881.
Meter No. 4

3/18/81.	Started	1.16 P.M.	Out at	6.03 P.M.	(287")
	"	7.05 "	— "	" 8.25 "	(80")
3/19/81.	"	8.40 A.M.	— "	" 10.50 A.M.	(130")
	"	10.57 "	— "	" 12.02 P.M.	(65")
	"	1.12 P.M.	— "	" 5.02 "	(230")
					792"

March 18, 1881.
Meter No. 5

3/18/81	Started	1.16 P.M.	Out at	6.03 P.M.	(287")
	"	7.05 "	— "	" 8.25 "	(80")
3/19/81	"	8.39 A.M.	— "	" 10.50 A.M.	(131")
	"	10.57 "	— "	" 12.02 P.M.	(65")
	"	1.13 P.M.	— "	" 5.02	(229")
					792"

March 18, 1881.

Meter No. 6

3/18/81	Started	1.17 P.M.	Out at 6.03 P.M.	(256")
	"	7.05 " —	" 8.25 "	(80")
	"	8.37 A.M. —	" 10.50 A.M.	(133")
3/19/81	"	10.57 " —	" 12.02 P.M.	(65")
	"	1.13 P.M. —	" 5.02 "	(229")
				793"

March 18, 1881.

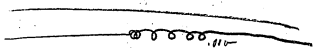
Meter No. 7

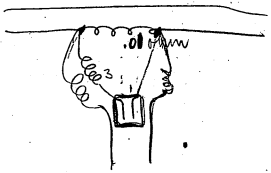
(366")	3/18/81	Started	1.17 P.M.	Out at 6.03 P.M.
		"	7.05 " —	" 8.25 "
(428")	3/19/81	"	(135") 8.35 A.M. —	" 10.50 A.M.
		"	(65") 10.57 " —	" 12.02 P.M.
		"	(229") 1.14 P.M. —	" 5.02 "
794"				

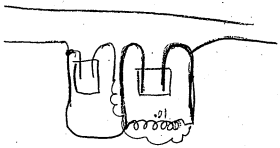
March 18, 1881.
Meter No. 8,

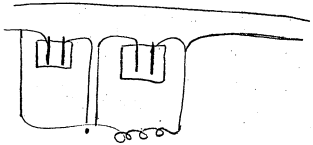
3/18/81 { Started 1.17 P.M. Cut out 6.03 P.M. (250)
" 7.05 " — Cut out 8.25 " (80)
3/19/81 { " 8.34 A.M. — " " 10.50 A.M. (130)
" 10.57 " — " " 12.02 P.M. (65)
" 1.14 P.M. — " " 3.02 " (228)

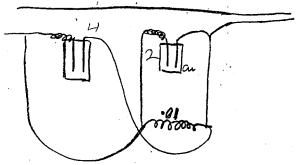
7951










4
2
a
1

Mar. 23, 1881.

Meter test.

1000
326
674

326 : 674 :: X : .0187385

$$\frac{326}{674} = \frac{X}{.0187}$$

326 x .0187 = 674 X

326
.0187385
112431.0
3374770
562155

674/6.1087510/.0906341 94/674

6066
4275
4044
2311
2022
2890
2696
194
674

Mar. 23, 1881.

Meter test.

1000
369
631:

369 : 631 :: X : .0187385
369
1686465
1124310
562145
6.9144065

631/6.9144065/.0109737 18/631

631
6144
5679
4650
4417
2336
1893
4435
4417
18 =
631

1000
490
510

490 : 510 :: x .0187

.0187 4
510 3
9 1870
9 5
9.5370

.0187 7 5
490 3 2 7
1 6830 3
748
510) 9.1630 (

1.3
3.9
1.3
5.2

510) 4900 (.96 Proof well
4590
3100
3060

.96
3
2.88

1000
570
430

570 : 430 :: x : 1
4

570) 4300 (.75
3990
3100

.96
2.88
3.84) 430 (570 (1.3
430
1700
1290

610 — 1000 / 611 / 389

611 : 389 :: 1

6 5 5 6 7

389) 611 (1.57
389
2220
1945
2758
2723

1.57 obus
3
4.71 Comp R
1.57 meter
6.28

.96 3
2.88 comp
96
3.84

21

q
s

q / q+s Thus s / q+s theory q

6.28
6.28 3.84

3.84
6.28
6.28) 10.12 (1.61
6 28
3840
3768
0720

1.61
2.61
421

3.84
62 2

3.84) 10.12 (2.61
7 68
2440
2304
0760

1000
611
389

R Hight call 1.57 ft.

611 : 389 :: x : 1

389) 611 (1.57
389
2220
1945
2750
32

1.57
3
4.71
1.57
6.28

1000
447
553

how call it ft.

447 : 553 :: x : 1

553) 4470 (.7
3871
599
42

553) 4470 (.808
4424
4600

.8
3
2.4
3.2

3.2
3.26.28

6.28
3.2
10.48

6.28
3.2
9.48

6.28
3.2
9.48

3.2
6.28+3.2
3.2
9.48

$\frac{3.2}{9.48} = \frac{1.6}{474} = \frac{.8}{2.37}$

2.37) .800 (.

80

$\frac{6.28}{9.48} = \frac{3.14}{474} = \frac{1.57}{2.37}$

2 2.37) .800 (.

2

237) 800 (.37
711
890
777

37
66
4

2 4

237) 1572 (.662
1480
1622
580

$\frac{80}{237}$ $\frac{157}{237}$

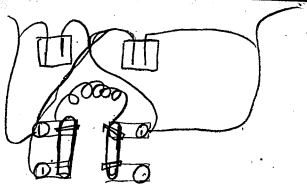
6.28 ohm
3.2

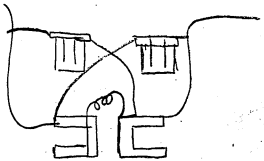
$$\frac{6.28}{6.28+3.2} \qquad \frac{3.2}{6.28+3.2}$$

$$\begin{array}{r} 6.28 \\ 3.2 \\ \hline 9.48 \end{array}$$

$$\begin{array}{r} 6280 \\ 5688 \\ \hline 5920 \\ 5688 \\ \hline 2320 \end{array} \quad (.662 \quad .337$$

$$\begin{array}{r} 3200 \\ 2844 \\ \hline 3560 \\ 2844 \\ \hline 7160 \end{array} \quad (.337$$





1000
441
559

441

441 : 559 :: X : 1

551) 4410 (.7
3857
5580

551) 4410 (.800
4408
2000

1000
379
621

379 : 621 :: X : .0157

379
.0157
2653
3032
379

621) 7.0873 (.011
621
877

427

1000
427
573

573) 4270 (.72
4011
1590

1000
402
598) 4020 (.67
3588
4820
4186
134

1000
357
643) 3570 (.55
3215
3550

$18\frac{5}{16} + 1\frac{4}{16}$

1000
387
613

387 : 613

6

887
.0197
2709
3096
3.87

613) 723.69 (.011
613
1106

1000
334
666) 3340 (.501
3330
1000

1000
641
359

641 : 359 :: X : 1

359) 5310 (1.7 ohms
641
359
2820

$$\begin{array}{r} 1000 \\ -\ 615 \\ \hline 385 \end{array} \qquad \begin{array}{r} 1000 \\ -\ 595 \\ \hline 405 \end{array}$$

615 : 385 3 5

$$385\overline{)615} \quad (1.5$$
$$\begin{array}{r} 385 \\ \hline 2300 \\ 2310 \end{array}$$

$$405\overline{)595} \quad (1.46$$
$$\begin{array}{r} 405 \\ \hline 1900 \\ 1620 \\ \hline 2800 \end{array}$$

low meter .50 of an ohm

1.4 & 1.4 ohms

$$\begin{array}{r} 1.4 \\ \times\ 3 \\ \hline 5.1 \end{array} \qquad \begin{array}{r} .50 \\ \cdot 1.5 \\ \hline \end{array}$$

Slate Paper

300,000

18000 020

25) 36 0,0 0 0,0 0 0 (14400000

110

100

100

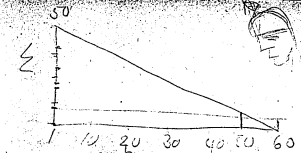
905 921
79

905 : 95 :: x : .0187

```
   905
  .0187
  ------
   6335
  7240
  905
95) 16.9235 (.18
    95
    ---
    743
```

921.79 :: x : .0187

```
   921
  .0187
  ------
   6447
  7368
  921
79) 17.2227 (.21
    158
    ---
    140
```

~~I tried~~

having set up 50 Wilson cell ~~put~~ their all in series and then try them on my lines, which had 104 Ω now when the current was closed I put the galv. at the beginning and it

only gave a def of about 8, (after research I found the cause of this, the batteries having so large a resistance themself it is nearly all lost in them when I close the circuit with only about 10 ohms.

I then took ten in series and 5 ten multiple arc and got a def of 10.

on $\frac{108 \text{ cell}}{540 = r}$

Def 319 = 5.4 r

Deflection on the beginning 308

*this time I got the potential at the extremity it was 307

then put it on the beginning again and it was 304 not quite

* then at this place again 337

then at the extremity 336

319 = 5.4 V

5.4) 3190. (59.
2707
490
486
4

59 def = .1 volts

59) 343 (5.813
295
480
472
80
59
210
177

59) 336 (5.695
295
410
354
560
531
290

5.813 V at the beginning
5.695 V at the Extremity

100) 5.813 (105813
11626

5.813 V beginning
5.713 V end

813
116
107

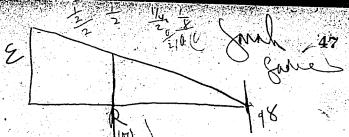
Bats, 4 V = 32.10 def

Line at Extremity,
342

at beginning 350.9

352.5 beginning
344.5 Extremity

Extremes 360
Beging 365


E
1/2
1/2
1/2

~~5 batteries = 320~~

5 cell = 26.15 def

def on lamp all at one end. Def on the begining 300.

def on Scremly 294

6.12 V at begining
6 at the Ended

Comes Exact with Calculated Res

54) 26.15 (5 $\frac{1.05}{5.40}$
20

54) 26.15 (49.1
21.6
495
486
9

49.1 def = 1 V

49) 300 (6.12
294
60
49
110 100) 6.12 (.0612
98
.1224

49) 294 (6
294

When lump
Are all divided
298. beginning
-94 End

when four in were
taken End 293.5
beginning 297.5

when 6 were off
278 beginning

8 wires
292.5 End
298 beginning

49) 292.5 (6.98 8
245 7
475
141
340

6.08
5.98
.11

49) 298 5 (6.08
294
400

10602
2
1200

10 well-fed

Exp No 1

1000 grams of white sand
100 gr " of litharge
300 gr " Rosin
1 measure of Molasses
1 " lin seed oil

This was boiled about 5 m

No 2

after 20 m cooling
This was not fluid ~~for~~
but a sort of plaster

No 3

some of the fluid
left from No 2

No 4

200 gr white sand
1/4 linseed oil
50 gr rosin

11

200 gr of sand
50 gr rosin
1/4 Wallseed

No 5

done at 11 only with
a little lin seed oil,

2182 D.R. (12 no)
Sod Gesso + chalk.

No 13
1/2 measure of Sand
1 of chalk
+ Glue water

No 14
Chalk + Glue water

15
Concentrated Solution of Alum
+ Chalk.

16
Plaster of Paris + Concentrated Alum. hardens quick

17
200 gr ~~Pb~~ lead oxide
1 measure chalk
Glue water

18
Same as above
only a little Glycerine

Sand + Glue

~~[illegible]~~

20
Litharge + Glycerine

6

Plaster of paris & glue water

7

Plaster of Paris glue and Alumes.

No 9

½ Measure. Sand

1 " Plaster of Paris

1 " Cor. Alum

sets quick

½ Measure sand

1 Plaster Paris

1½ " Cor. Alum

Samp 10

sets a little slower

No 31

1 Measure Plaster Paris

of " of Sal water

Measure 32

1 Glue water

2 Plaster Paris

33

1/4 Measure Plaster Paris
1 Sand
1/2 Glue water

84

1 measure Plaster
1 Sand
1 1/2 Glue water

36

3/4 Measure Con Alum
1 Measure Plaster Paris

8 r

1 Plaster
1 Measure Con Alum

29

Same as above No 28

39

1 Measure Plaster of Paris
1/4 oz of Glue water
3/4 oz Alum Con'

20

1 Measure Plaster of Paris
1 " Cow Dung
1/4 Glue water

28

1 1/4 Measure of Cow Dung
1/4 Glue water
1 meas Plaster of Paris

1000000
150000

183.0000 100

1830000 20

366,000000

18,300000 20

366,000,000

May 24 1881

Copper wire sent by Moore from Phil. to be tested for Cond. to Eng. Bureau

497 : 503 :: X : .06 —

Temp 88.7°. 23 1/3° R.

1 Measurement.

502 : 498 :: .06 — : X

Second measurement

Temp 88.7 20 1/3° R

Length 114 feet

Diameter .134

Double covered cotton

F. G.

.0659274 log = $\bar{2}$.8190659

$\frac{502.5}{4975} : 497.5 :: \frac{.065-}{X} : X$

502.5X = 497.5 X .065 —

$\bar{2}$.8190659
2.6967931
$\bar{1}$.5158590
2 707 1361

$\bar{2}$.8147229 = Res =

.0652714 = Res of wire

at

134^2 log = 2.1271048
2
4.2542096 = 17956.

9.718 log = 0.9875769
4.2542096
4.7333673
2.0681859
$\bar{2}$.8015532
0.0472749
$\bar{2}$.8488281

.0038230
.0114720 Corr. for Temp

.115

.0659274 X 1.004433 = .0662306561942

This is correction for the temp of German Silver wire for 10 degrees C.

$\bar{2}.8270548$
2.6967931

1.5178479
2.7011361

$\bar{2}.8867198$ .065571

May 26 1881

German Silver wire sent by Bergmann to measure resistances per foot for that experiment in distribution.

Spool no 1 large wire

.0365 diameter Temp 80°F

595 : 405 :: X : 2

$\frac{595}{405} = \frac{X}{2}$

405) 1190 (2.93 ohms
810
3800
3645
1550
1215

Length 24.11 or 29.9 feet

$\frac{605}{395} = \frac{x}{4}$

395) 2420 (6.12 ohms
2370
0500
395
1050

$\frac{597}{403} : \frac{x}{4}$

403) 2385 (5.92
2015
3730
3627
1030

Spoole no 2 Temp 60°F

605 : 395 :: X : 4 = 6.12 ohms

Dia .025"

Length 25' ½"

120) 300.04 25.04 feet

Spoole no 3 Temp 60°F

597 : 403 :: X : 4 = 5.92 ohms

Dia .025"

Length 25' ½"

$\frac{695}{305} = \frac{X}{10}$

305) 6950 (22.78
610
850
610
2400
2135
2650
2440

381) 6190 (16.24
381
2380
2286
940
762
1780
24
4

No 4 Temp 80 7°/69

695 : 305 :: X : 10

22.78 ohms

.0125 Diameter

Length 25' 1"

No 5 Temp 7° 81 7°

619 : 381 :: X : 10

16.24 ohms

Di .0160

Length 25' 1"

$$\frac{674}{326} = \frac{x}{15}$$

674
15
3370
674

326) 10110 (31.01
978
330
326
400

No 6 Leng. 80 7/71

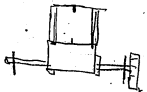
674 : 326 :: x : 15

31.01 ohms

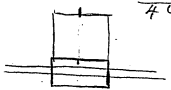
.007 Drawing

length 12' 7½"

75) 120 (1.6 120) 150 (.62
75
450
450

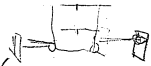


607.2
165 $CuSO_4$
442.2



1175
1010
165

$CuSO_4 = 165$
H_2O 442.2



165)442 (2.68
330
1120
1155

82 221 4 2
42 110
21 55 2 6
7 14 1 3

Sulphate Cu solution at freezing point

Beaker weighs 1010 grams
1617.2

Beaker with solution 1617.2
Solution alone 1010
607.2 gr
Sulphate of Cu alone with Beaker 1175

I took the above solution and made it saturated and then put it in ice got 0 temp, and then decanted the liquid, left the deposited crystals behind.

I made the saturation point by taking 165 g $CuSO_4$ to 442 H_2O.

standard arm of bridge 90 ohms
I commenced the experiment
by first putting very hot water
in the pail. Room temp 74°7
Thermometer 97°7 divisions 577
" " " 105° " " 575
106°5 572
106.75 569
it decreased slowly, here
I put some cool water
in to decrease the temp
Temp 97°7 = divisions 567
Room 76°7
Temp 90 divs. 563
" 80 558
The wire seems to cool faster
than the solution.

7°C	717	divisions 533
6°		530

Took the cell + put it in ice water and got the following Res.

1 ohm in standard arm

8°C	645
7°C	646
	647
10°	609
12	590.5
13	579
15	566

		Res.
8°C	divisions 645	1.82
7	" " 646	
10	" " 609	1.5
12	" " 590.5	1.4
13	" " 579	1.3
15	" " " 566	1.3
18	" " " 535	1.1
19	" " " 532	1.1
20	" " 527.5	1.1

5	656
9	606
10	591
14	557
15	545
16	535
18	520
20	507
21	500 = 1 ohm

Water 9c divisions
9c ... 492

Water when put in 68°C at 4905

62	4905
60	4875
58	" "
57	" "
55	490
44	497
36	500
30	503
20	510
15	515
10	520
5	

$\frac{1}{600+1}$ Through cell

$\frac{600}{600+1}$ Through shunt

601) 1.000 (.001663W
601
3990
3606
3840
3606
2340

601) 600.00 (.998336W
5409
5910
5409
50100
4800
2020
1803
2170
1803
3675
3606

.001663 watts on cell
.326
9978
3326
4989
.0005421 38 mg of Cu 1 Sec.
60
.032528280 mm.
60
19.5169680600 1 hr
5 hrs
97.584840300 5 hr
30
2927.545209000

.326 3 1
60
19.560
60 3
1178.600

.001660 3
60
.0600

.001663
.326
9978
3326
4989
.0005421 38 1 Sec
60
.032528280 1 m
60
19.516.93800 1 hr
97.584690000 5 hr
30
2927.54070000 mg for
1 lamp burning 5 hr day + 30
days mg.

Cee

1 put on 1.50 P.M.
1 Ohm at 1.55 P.M.
Stop at 2.15 (74 duration

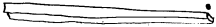
2
Put on at 2.17
1 ohm at 2.30
Stop at 2.42

3 put on at 2.48
Stopped at 3.8 P.M. duration
79

June 4 1881

Test of Three Copper bars.

First bar, without any joints clear



286 : 714 :: X : .008 2409

286	X
714	.008

714) 286 × .008

2.456 3660
3.9159746
0.3723406
2.8536952
3.5186724 = 33009
= .00 33009 ohms

87) .0659274 without joints .00 33009
.0082409 with " .00 34689
Soldered " .00 34152

Second bar
connected by four joints
not soldered
screwed light

296 : 704 :: X : .008 2409

3.9159746
2.4712917
0.3872663
2.8475727
3.5396936
.00 34649 ohms

Third bar same as second but soldered

296 : 707 :: X .008 2409

296
707
3.9159746
2.4686716
0.3828422
2.8494194
3.5334228 34152
= .00 34152

June 5 1887

#75

20

wire .009 = 7.8 feet per ohm at 60°

7.8
18

0.8920946
1.2552725
2.1473671 = 140.40

140.40 feet of .009 = 18 ohms

60°
28

18 = 1.2552725
× .9429 = 1.9744456

1.2297381 = heat of
0.8920946

138 feet at 0°

2.1218327 =
132.8881

138 feet of No .009 wire at 0° = 18 ohms!

Same wire at 60° =

2.1218327
0.0255107
2.1473434 1.0605

0.0255107

1.2297381
0.0255107
1.2552488 17.999

1.2552725
0.0255107
1.2807832 = 19.089

19.089 ohms

19.089 ohms at 60° = 18 ohms at 0°

1.2807832
0.8920946
2.1728778 = 148 ft

Bal for Mr Kress &
Copper 96% Cu + 4% Sn

315
314
308

3737
312.8 Cast

293
301.52
298

3892.5
297.5 "

312 : 688 :: X : .0082409
688 .008

June 5 1881

2.4941546
3.9159746
0.4101292
2.8375884 Cast
3.5726408 .0037371 Res

297 : 703 :: X . .0082409

93%

3.9159746
2.4727564
0.3887310
+2.8469583
3.5417757
.0034815 pure Cu

June 5 1881

Meter Experiments

Weight of Plates

No 10 deposited 1220+3.9 = 1223.9 grams

No 10 1150
152
1165.2 grams

deposited 122.4

No 8 deposited cell

Weight = 1192 grms
~~1194.4~~

No 8 1160.9 grms
deposited 1194.4

No 4 deposited plates
1170
14.9
118.4.9 grms

No 4 deposited 1127.5 grms
1187.2
1285.1

No 6 deposited 1214.2 grms

No 6 1091.9 grms
No 6 deposited 1216.6
1084.3

No 3 deposited 1257.19

No 3 — — — — 1123.5gr

no 3 deposited. 1259.7
no 3 — — — — 1121.1

No. 0 deposited 1190.4gr

No. 0 — — 1073, 8gr
.31

no deposited 1192.9 30
no — — — 1171.4 $\frac{1}{2}$

$\frac{1}{82}$

80)100(1.2

Put the current on at one o'clock P.M. June 5 1897

Put the current off at 9 P.M.

2.5
2.4
2.3
2.4
2.6
2.5
147
2.45

grains
1 ~~grains~~ = .0647988 grams

2.7 — 2.8115616
3 — 0.3891661
— 1.2007277

2.45 grains = .15875 grams

1257.1
1257.1
2.6 .3267 w

w which is in seconds

92.9
70.4
2.5

60
60
3600
28800

4.4593925 — 1.2007277
1.5132176 — 3.9726101
3.9726101 — 5.2281036

.00016988

One new Standard cell.

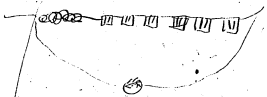
deflection ~~329 — 359~~

352 — 335

deflection between the

H two ends of the depositing

cells + Resistance



144 — 154 def

Standard cell

333 —— 353

On deposition cells + resistance 157 — 142

142 — 157

On Resistance wire alone. 91 — 103

91 —— 103

Standard cell

353 —— 332

333 —— 359

333 359

def on depositing
cell . 56 —— 48
56 — 48

Standard cell
352 — 333
358 — 333
358 — 333
358 — 333

On cell 0
5 — 14
5 — 4

On cell 3 13.5 — 5
13.5 — 5

On cell 6 . 14.5 — 13.
4.5 . 13.

On cell 4 14 — 5
5 — 14

On cell 8) 12.5 — 3.5
12.5 — 3.5

On cell 4 — 13.5
4 — 13.5

Standard cell
332 —— 358
332 —— 358

Sunday night 8
~~Depos~~ Cell June 5 1881

Put current on at 11.30
P.M.

Stop June 1881
Stop at half past four
4.30. Going 41 hours.

30 24
R 4
1

30 24
30 12
4
1

30 24
12
8

41 hours 31

June 7 1881

No 8

deposited plate 1272.gms
1259.7
gain 12.3

12826
1272.
10.6

No. 10

deposited plate 1238.7 gms
1226.4
gain 1.2.3

1249.4.
1238.7
10.7

37)10.5 grams

370)1050 (.2
740
810

10.6
10.5
10.5
10.7
10.6
10.7
6)636
10.6

370)10.60 (.28
740
3200
2960

370)1060 (2.89
740
3200
2960
2400
90

.36

No 8

deposited plate 1206.8 grams
~~1187.2~~
1194.4
gain 12.4

1217.3
1194.4
1217.3 2.9 grams
1206.8
10.5

No 4

deposited plate 1199.5 grams
1187.2
gain 12.3

1210.5
1199.5
10

12.3
12.3
12.3
12.4
12.5
12.5

8 hr = 2.45 grams

6) 74.8
12.39 grams in 41 hours

8) 41 (5.12
40
1.0
2

5.12
2.45
2560
2048
1024
12.5440

1 hour typical experiment .3062 gr
by second Experiment .302 grams
.284
difference .016 mg

.302

1302
100) 302

100) .302
3.2) 1.5 (5
160
34
5

No 6

deposited plate 1229.1 grms
1216.6
gain 12.5

1239.7
1229.1
10.6

No 0 Sl.

deposited plate 1205.4 grms
1192.9
gain 12.5

1215.9
1205.4
10.5

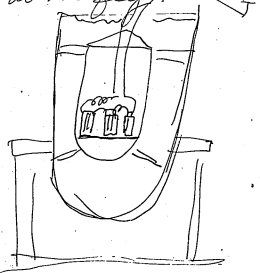
.302
07
2114
906
11.114

June 8 1881

Put current on cell at 8.30 AM.

Stop current just at 9.30 P.M.

The cell are all in the calorimeter as shown in the fig.



50) 3350 (7
350

1 battery 1 day

50 bat 234 ~ 3239

2

234
239
2) 473
236

26
5

7) 236
33.8

~ 5

50 batteries 33.7 charges than the one.

one battery alone through the Resi 304 — 313

~~205~~ 200 def with all the batteries on indicator

```
      308
     8317
     2156
    924
    924
   10379.6
   183000
  3113880000
  8303688
 103796
200)189946668000(947334000
    800
    1946
    1800
     1466
     1600
      1680
      1600
       800
       800
```



```
   307
   813
  2617
  308
```

```
100)5280(52
    500
    280
```

```
3   183000
     308
   ------
     308
    8317
   ------
    2156
    924
    924
   10379.6 def with all ave
   183000
  ---------
  3113880000
 8303688
10379 6
200)189946668000(949733
    800
    1946
    1800
     1466
     1600
      1680
      1600
       800
       800
```

```
94973 3 4
   994
   1946
   1800
    1466
    1600
     1680
     1600
      800
      800
```

```
52.8
100
5280.0
```

```
52.8
100
5280.0
```

Plate No. Plate No 85

52.8) 9.497.3340 (179.8.73
5284 7×44
4217
3694
5213
4752
4613
4224
3894.2
3696
1980
1584

Frances Menlo Park N.J.

Thomas A. Edison

Hon John K. Porter
333 Fifth ave
N.Y.

Frank K

June 11 1887

German Silver wire for Standard resistance boxes

$\frac{986}{14} = \frac{X}{.06}$ .0659274 Log = $\bar{2}.8190659$

$\frac{986 \times .065}{14}$

Marked 30½.

$\bar{2}.9938769$
$\bar{2}.8190659$

1.8129428
1.1461280

0.6668148

4.63 ohms

Marked 32

$\bar{2}.8190659$
2.9960737

1.8151396
0.9542425 8

0.8608971 = 7.25 ohms

Marked 30 $\bar{2}.8190659$
2.9916660

1.8107349
1.2787536

0.5319813 = 3.40 ohms

2.8190659
2.9934362

1.8125021
1.1760913

0.6364108 = 4.33

Marked 29

Marked 23

2.8190659
2.9661417

1.7852076
1.8750613

1.9101463

.813 ohms

Marked 31

2.8190659
2.9947569

1.8138228
1.0791812

0.7346416

5.42 ohms

Marked 25

2.8190659
2.9845273

1.8035932
1.5440680

0.2595252 = 1.81 ohms

Marked 20

2.8190659
2.9566486

1.7757145
1.9777236

.7979909 = .628

Marked 26.

2.8190659
2.9800034

1.7990693
1.6532125

0.1458468 1.39 day

Marked 25

-2.8190659
2.9894498

1.8085157
1.3802112

0.~~4~~283045 = 2.68

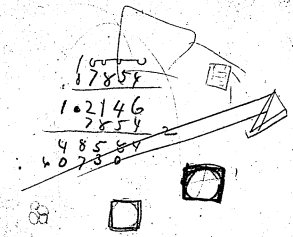
Marked 24

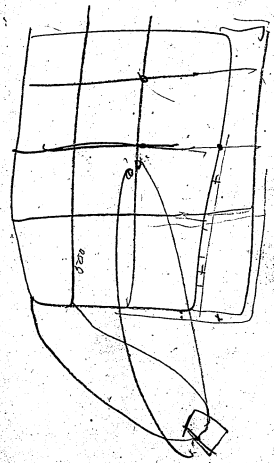
-2.8190659
2.9694159

1.7884818
1.8325089

7.9559729

.903


17854
102146
78542
485684
407300


020
20 Block

Menlo Park Notebook #231 [N-82-08-28]

This notebook covers the period August 1882-March 1883. The entries are by Hermann Claudius and consist of calculations relating to conductors for central stations in the 28th District of New York; Milan, Italy; Roselle, New Jersey; St. Iago di Chile (Santiago, Chile); and Shamokin, Pennsylvania. Several loose pages found in the book contain additional notes and calculations regarding the New York, Roselle, and Shamokin stations. The label on the front cover is marked "Measurements of networks for electric illuminating by Hermann Claudius." There is an index on the inside front cover. The book contains 280 numbered pages.

Blank pages not filmed: 12-149, 208-239, 270-279.

XE 172
N-82-08-28

Index.

28th District of New York City . . . . page 1
Milan 151-168
Roselle 169-206
Hyaqo & Chalk 241-256
Shannahan Da 257-263

28th District

1' german silver wire (annealed) = 0.00855158 Ohm
Ratio: 1:240 or 1" = 20'. equal 289911 circ. mils copper.
1 Lamp = 140 Ohm. Def wire 0.135"
Until now (February 1st) 47147 Lamps and 3819 poles.
Insulation tested before the second wire of coils was connected and found perfect

Experiments for Mr. Strange.

10 Feeders, at 8 Chains one pole, at Mr. Strange's spans and Chains other pole. Set every southern corner one feeder and close by clamps to take potentials. Resistance of these 10 feeders in multiple are but connected together at end: 0.0232138 Ohms, temp: converted to 71° F.

Feeder 1^b 95^m = 97^c feeder 1^f 70^m
" 2^c 90^m " 2^f 66^c
" 3^c 96^c Sect. 1 " 7^f 81^c
Sect. 1 39^m

Feeder 5^d 188^c.

Potentials taken both poles at the same time.

Feeder 1^a = 200
" 2^c = 188
" 3^c = 189.5
" 4^c = 189
" 5^c = 181
" 6^c = 179
" 7^c = 182.5
" 8^c = 185
" 9^c = 185
" 10^c = 179.5

Sect. 1 = 116

Feeder 1^b = 139
" 2^c = 133
" 3^c = 155
" 4^d = 155.5
" 5^e = 150
" 6^f = 152.5
" 7^g = 158
" 8^g = 160
" 9^g = 158
" 10^g = 155

Feeder 1^a = 197.5
" 2^c = 185
" 3^c = 181
" 4^c = 178
" 5^c = 178

feeder 1^b = 136.5
" 2^d = 131
" 3^e = 162.5
" 4^f = 153
" 5^f = 147.5

Potentials at both ends at same time.

Feeder 1^a
290
Feeder 2^c
276
Feeder 3^d ... 315 ...
" 4^c — 302.5 — 312
" 5^c — 292.5 —
" 6^c — 277.5 —
" 7^c — 302 —
" 8^c — 303.5 —
" 9^c — 300 —
" 10^c — 286.5 —

Feeder 1^b Sect 1 = 114 = 2.5^m
" 2^b
" 3^b 6 H.13 = 107.5
" 4^b
" 5^b
" 6^b } H.22 = 103
" 7^b } H.33 = 99.5
" 8^b
" 9^b } H.36 = 102
" 10^b H.39 = 102.5

Short circuit Station 1 = 257

Station 1 = 257

H. 2 near pole 1^f = 122.5 ; H. 5 near feeder 2^a = 158;
" 6 " " 3^c = 144.5 " 10 " 3^a = 143.5
" 12 opposite H.13 = 106 " 14 b.h. 3^c 7^g = 105
" 7 3^a opp. H.14 = 104.5

19 5.5
12 2.1
195.6 30 | 26
24
5.0

Feeder 1 a = 195,5
" 2 a = 182,5
" 3 a = 179
" 4 a = 176
" 5 a = 175,5
" 6 a = 173
" 7 a = 176,5
" 8 a = 178,5
" 9 a = 179,5
" 10 a = 172,5

Feeder 1 b = 132,5
" 2 b = 128
" 3 b = 160
" 4 b = 150,5
" 5 b = 145
" 6 b = 147,5
" 7 b = 152,5
" 8 b = 154,5
" 9 b = 153
" 10 b = 150

Ex. on 5 feeder 1 a = 193,5

H. 8 Ex. Cor. a = 110 H. 8 Cor. p. 1 b = 102,5
H. 9 Cor. = 111 " 11 " " 4 a = 155,5
H. 20 Cor. 6 a = 144 = 115 H. 27 " H. 28 = 133,5 = 132
" 29 Ex. 4 6 a = 6 b = 115,5 H. 27,5 Ex. p. 7 a = 94,5
" 29 Ex. 4 6 a = 7 a = 94 = 43,5 %

H. 38 Cor. Cor. feeder 10 a = 10 b = 104,5

Ex. on feeder 1 b = 195,5

Febr. 6th 1883.

Feeder 1 a = 215
" 2 a = 201,5
~~" 3 a = 192~~
" 4 a = 199
~~" 5 a = 194~~

Feeder 1 b = 144,5
" 2 b = 141,5
~~" 3 b = 146~~
" 4 b = 165,5
~~" 5 b = 149,5~~

Feeder 1 H 2 = 122,5 H 2 = 131,5 H 5 = 170,5
H. 9 = 113 H. 10 = 113,5 H. 6 = 151,5 H 10 = 162,5
H. 11 = 172 H. 12 = 113,5 H 12 = 113,5 H 15 = 116
~~H. 16 = 11~~

Feeder 3 a = 193,5
" 4 a = 190,5
" 5 a = 191,5

Feeder 3 b = 133,5
" 4 b = 163
" 5 b = 157,5

H. 16 = 123,5 H. 17 = 106,5 H. 18 = 120,5 H. 26 = 139,5
H. 25 = 118,5 H. 24 = 102,5 H. 29 = 110 H. 30 = 102,5
H. 30 = 137,5 H. 30 = 152

feeder 6 a = 187,5
" 7 a = 190,5

feeder 6 b = 159,5
" 7 b = 164,5

H. 30 = 99,5 H 31 = 100 H 29 = 122,5 H
7 a = 190,5
8 a = 192,5

7 b = 164
8 b = 157,5

H. 32 = 106 H. 33 = 102,5 H 34 = 99 H 35 = 100

Feuilles $9^a = 194,5$ Feuilles $9^b = 169,5$

$10^a = 184,5$ $10^b = 160$

#36 = 166 #37 = 190 #38 = 180 #39 = 106,5

Feuille $1^a - 1^b = 307,5$ corrected when factors in section 8/2

" $1^a - 1^b = 55$ " " " " " " " 1 " "

" $1^a = 1^b = 87,5$ 1^a opposite when factor varying

" $1^a = 1^b = 150$ 1^a same contractor when factor varying as before, only were changed on ~~other~~ opposite examples

---

8/2 1883

Second series of measurements 11.

+ 6th 6 assume meet and cast 4 bars alike

− at 8 " and Maintained 8 bars

− feuille 1^a 309 + feuil. 1^a 301,5 + feuil. 1^b 301,5 − $f1^b$ 184,5

#1 = 284 #2 = 265

− $f2^a$ 274,5 + $f2^a$ = 258 + $f2^b$ 255 − $f2^b$ 249,5

#7 = 241,5 #14 = 229,5 #6 = 238 #10 = 249

9/2 1883

Summa as 8/2 1883

− feuil. 1^a 195,5 (197) + feuil. 1^b 190,5 + $f1^a$ + feuil. 1^a = 190,5 + $f1^a$ − $f1^b$ 169,5 (157)

#1 = 179,5 #2 = 167,5 #3 = 150 #4 = 179 #5 = 150 #6 = 157

$f2^a$ = 2 cents.

#7 = 134 #8 = 190 #9 = 128,5

− $f2^a$ = 180,5 + $f2^a$ = 169,5 + $f2^b$ 168 − $f2^b$ = 165

#10 = 164 #11 = 157,5 #12 = 160,5 #13 = 166

#14 = 152 #15 = 125,5 #16 = 128,5 #17 = 128,5

#18 = 129 #19 = 142

− $f3^a$ = 179 + $f3^a$ = 157,5 + $f3^b$ = 155 − $f3^b$ = 145

#20 = 140 #21 = 149,5 #22 = 149,5 #23 = 125,5

#24 = 120 #25 = 121,5 #26 = 133 #27 = 136,5

#28 = 159,5 #29 = 148,5 #30 = 121 #31 = 120

− $f4^a$ = 167 + $f4^a$ = 150 + $f4^b$ = 147,5 − $f4^b$ = 142,5

#32 = 142,5 #33 = 141 #34 = 122 #35 = 127,5

#41 = 136

− $f5^a$ = 151 + $f5^a$ = 144 + $f5^b$ = 147,5 − $f5^b$ = 146

#36 = 133 #37 = 124,5 #38 = 115 #39 = 119,5

#42 = 128 #43 = 129,5 #44 = 115

− $f1^a$ = and 209,5

8 12/2 1883

Same as 9/2 and 8/2.

$-f1^{a}=155,5$ $+f1^{c}=151,5$ $+f1^{e}=151,5$ $-f1^{g}=133$

H1=142,5 H2=133,5 H3=119,5 H4=136

H5=127,5 H6=136 H7=107 H8=103,5 H9=102

$-f2^{a}=138,5$ $+f2^{c}=130,5$ (Hm=116) $+f2^{e}=129$ $-f2^{g}=126,5$

H10=125,5 H11=120,5 H12=122,5 H13=127,5 H14=116,5

H15=96,5 H16=99 H17=95,5 H18=94 H19=100

136,5

13/2 1883

Same as 9, 8. and 12/2. 1883

$-f1^{a}=182,5$ $+f1^{c}=177,5$ $+f1^{e}=177,5$ $-f1^{g}=155,5$

H1=167 H2=155,5 H3=139 H4=158,5

H5=147,5 H6=139 H7=127,5 H8=119 H9=112,5

$+f2^{a}=162,5$ $+f2^{c}=150,5$ $+f2^{e}=149$ $-f2^{g}=145,5$

H10=145 H11=138,5 H12=133 H13=141,5

H14=146,5 H15=139,5 H16=109,5 H17=112

H18=108,5 H19=106,5 H20=124

$+f3^{a}=150$ $+f3^{c}=137,5$ $+f3^{e}=135,5$ $-f3^{g}=129$

H21=122,5 H22=126 H23=130 H24=109,5

H25=105,5 H26=115,5 H27=119

H28=138,5 H29=120,5 H30=105 H31=104

$-f1^{c}=180$

$+f4^{a}=141,5$ $+f4^{c}=129,5$ $+f4^{e}=127,5$ $-f4^{g}=128,5$

H32=123 H33=127,5 H34=105 H35=102,5

H36=116,5

$-f1^{c}=178,5$

$+f5^{a}=137,5$ $+f5^{c}=133,5$ $+f5^{e}=126,5$ $-f5^{g}=125$

H36=112,5 H37=105,5 H38=97,5 H39=100,5

H40=108 H41=104,5 H42=96,5

$-f1^{c}=176,5$

Gr. 12. Cept at end

February 19th 1893

+ Feeders moved from 6th Crossing to the west end east.

$-f1^{c}=272.5$ $+f1^{e}=242.5$ $+f1^{g}=212.5$ $-f1^{i}=202.5$

$H1=260$ $H2=197$ $H3=182.5$ $H4=238$ $H5=222.5$

$H6=211$ $H7=161$ $H8=162.5$ $H9=161$

$\cancel{H}\ 1^{c}=275$

$-f2^{c}=242$ $+f2^{e}=219.5$ $+f2^{g}=186.5$ $-f2^{i}=202.5$

$H10=222$ $H11=207.5$ $H12=201$ $H13=170$

$H14=\cancel{193}\ 173$ $H15=197.5$ $H16=182.5$ $H17=167.5$

$H18=150.5$ $H19=151$ $H20=175$

$-f1^{c}=275$

$-f3^{c}=229$ $+f3^{e}=204$ $+f3^{g}=152.5$ $-f3^{i}=179$

$H30=184.5$ $H31=192.5$ $H32=154$ $H33=143$

$H34=145$ $H35=148.5$ $H36=162$ $H37=160.5$

$H38=207.5$ $H39=170$ $H40=\cancel{149.5}\ 137.5$ $H41=137$

$-f1^{c}=274$

$-f4^{c}=215.5$ $+f4^{e}=\cancel{197}\ 189.5$ $+f4^{g}=176$ $-f4^{i}=184.5$

$H42=\cancel{214.5}\ 142.5$ $H43=140$ $H44=134$ $H45=135.5$

$H46=145.5$

$-f5^{c}=206$ $+f5^{e}=179.5$ $+f5^{g}=189$ $-f5^{i}=199$

$H46=197$ $H47=158$ $H48=135$ $H49=133.5$

$H50=163.5$ $H51=\cancel{160.5}\ 155.5$ $H52=137$

$-f1^{c}=275$ 4 [illegible] left at end

While the network decreased by order, work taken for other purposes.

Hermann Ekenchi

Milan

I 28/8 1882

1 Feder,

1. 430 — 422
428 — 421
427 — 420½

2.) 423 — 407
421½ — 406
420½ — 405

3.) ~~410 — 385~~
417 — 383
416 — 382
415 — 381

4.) 412 — 357
412 — 357

5) 409 — 340
408 — 338
407 — 338

6.) 406 — 327

7.) 405 — 320

8.) 397 — 310

9.) 396 — 309

87 22 2

396 : 87 = 4 22/87 2
— 348
— 480
— 348

II

2 Feeders

1.) 391 — 387½

2.) 391 — 382½

3.) 391 — 373

4.) 391 — 377

5.) 390 — 377

6.) 389 — 381

7.) 388½ — 370

8.) 388 — 369

III

2 Feeder moved.

1.) 388 — 383

2.) 372 — 371

3.) 372 — 361

4.) 372 — 360

IV

2 Feder mord

4) 369 – 362

2) 367 – 363

5) 367 – 359

6) 367 – 360

8) 374 – 371

2 Feder. 29/8 1882

1) 346 – 344

2.) 347 – 345

3) 347 – 349

4) 347 – 352

5) ~~347~~
344 – 347

6.) 345 – 347

7.) 346 – 346

8) ~~356 – 362~~
342 – 346

9) ~~341 – 349~~
343 – ~~359~~ 340

2. Feeder measurement

1.) 351 — 354

4.) 346 — 349

2 Feeders:

~~Last measurement~~:

1.) 347 — 346 = −1 = 0,29‰

2.) 347 — 346 = −1 = 0,29‰

3.) 347 — 350½ = +3½ = 1,00‰

4.) 348 — 351½ = +3½ = 1,00‰

5.) 349 — 349 = ±0 = 0‰

6.) 350 — 350½ = +½ = 0,14‰

7.) 349 — 347 = −2 = 0,57‰

8.) 349 — 353 = +4 = 1,14‰

9.) 350 — 346 = −4 = 1,14‰

~~202,65~~ ~~149~~ ~~664,69~~ ~~619,62~~

Length of feeder No I ~~202,65~~ m = ~~6746'~~

" " II ~~447,35~~ = ~~1467,31~~ ~~408,77~~ ~~1329,38~~ ~~408,77~~ ~~1329,38~~

1 = 0,58‰; 2 = 0,58‰; 3 = 2,02‰; 4 = 2‰;

5 = 0‰; 6 = 0,28‰; 7 = 1,14‰; 9 = 2,28‰;

9 = 2,28‰

~~Double~~ lengths of feeders in feet

I = ~~1357,92~~ 664,69 × 2 = 1329,38

II = ~~2934,62'~~ 1329,38 × 2 = 2658,76

1290 Lamps à 140 Ohm = 0.10853 Ohm = 85 %
network . . . . = 0.00319 " = 2 1/2 %
2 feeders . . . . = 0.01596 " = 12 1/2 %
0.12768 = 100 %

1 feeder therefore 0,03192 Ohm resist.

2 π = 4 tubes = 365768 circ. mils

Germantown mains represented 248258 circ. mils copper

Greatest fall, reduced to 1/2, was 2,28 %

Therefore loss in the network of 2 π = 4 tubes:

365768 : 248258 = 2,28 % : x %

x = 1,58 %

Street mains = 1,5 % = 0.00184 Ohm
Feeders = 10 % = 0.01226 "
1290 Lamps à 140 Ohm = 88,5 % = 0,10853 "
= 100 % = 0.12263 Ohm

1 feeder therefore 0,0 2 4 5 2 Ohm resistance
feeder I = 560053 circular mils
II 1120106 "

30 | VIII | 82.

total resistance of the Milan board = 0,1171175
Resistance of 1290 lamps = 0,108527
Resist. of the giving feeder = 0,002988
" of the return feeder = 0,003054
together 0,006042 − 0,006042
0,114569 − 0,114569
Resistance of the street mains = 0,002548 5

measured at 78° F.

Hf
Lamp.

664,69' tubes π 2 1/2 } feeders
1329,38' " " 1 1/2 }
2 743,33' " " 4 street mains.

Greenpoint
Aug: 30th 1882.

Claudius
786

4) 0.108527 = 93 %
0.006042 = 5 %
0.002548 = 2 %
0.117117 = 100 %

The greatest difference was 1,14 % only and can temperature alone not be of so great an influence. CL.

Milan:

1375 L'Scala
2471 Metmark
3846 Lamp

Test for insulation before soldering the second wire:
Bells, high resist. galv.:
Deflect. 0.

8/9 1882

I.

1.) 386 – 385½ = ½
2.) 378 – 375½ = 2½
3.) 379 – 379 – 0
4.) 397 – 378
5.) 374½ – 401½
6.) 372½ – 382½:

7.) 370 – 381½
8.) 373 – 385
9.) 370 – 407½
10.) 370 – 388
11.) 370 – 384
12.) ~~369~~ – 384 = 368
13.) 370 – 389
14.) 369 – 383½
15.) 370 – 379
16.) 369 – 377½

II

1.) 384 – 386
2.) 386 – 386
3.) 386 – 387
4.) 385 – 396
5.) 386 – 400
6.) 386 – 396
7.) 385 – 397
9.) 385 – 386
8.) 388 – 403

10.) 387 – 391
11.) 387 – 388½
12.) ~~389 – 390~~
390 – 388
13.) 385 – 391
14.) 385 – 385
15.) 385 – 380
16.) 385 – 380

III

1.) 380 – 382½
2.) 380 – 379
3.) 380 – 386
4.) 380 – 391
5.) 380 – 396

4.) 381 – 391½
7.) 381 – 391½
8.) 380 – 395
9.) 381½ – 386½
10.) 380½ – 385½
11.) 380½ – 383
12.) 380½ – 381½
13.) 381 – 383
14.) 381 – 387½
15.) 381 – 388
16.) 381 – 384½

IV

1.) ~~385~~ – 385½
3.) 385 – 385½

4.) 384 – 395
5.) 385 – ~~386~~ 390
6.) 385 – 389
11.) 385 – 385
12.) 385 – 385½
13.) 385 – 386
14.) 385 – 391½
15.) 385 – 399½
16.) 385 – 389½

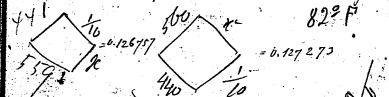
V. 9/9/1882

1.) ~~449 – 401~~
398 – 399½ = +1½
2.) 398 – 397 = –1

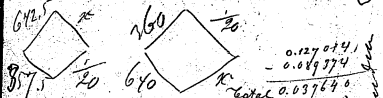
3.) 397½ – 398 = +½
4.) 395 – 405½ = +10½
5.) 398 – 392½ = –5½
6.) 392 – 401½ = +9½
7.) 391 – 402 = +11
8.) 390 – 404 = +14
9.) 389 – 392½ = +3½
10.) 387½ – 390 = +3½
11.) 387½ – 388½ = +1
~~12.) 385½ –~~
12.) 385 – 385 = 0
13.) 385½ – 385 = +½
14.) 386 – 391 = +5
15.) 384½ – 391½ = +7½
16.) 383 – 387 = +4

Distance from I. Station to Tred. I 0,807 = 188,03
616,73'
" " 1084,43' " II 1,419 = 330,62
" " 1645,57' III 2,155 = 501,64
" " 1581,97' IV 2,071 = 482,31

Measurement of the whole network 822 F.



Measurement of the feeders



0.127 0441
− 0.089374
Cotse 0.037640
− Bumpo 0.036402
0.001238
0.089374
remains for theatre

0.001238 = c. 3% of 100% or 0.0412715 and (ratio 8/14 = 3/7 = 0.42857) of 390.

Scale theatre cut off 1 feeder.

~~1) 355 = 356~~
2) 334 – 332
3.) 333 – 333½
4) 332 – 342
1.) 331 – 332
5) 330 – 337½
6) 332 – 340
7.) 332 – 340½
8.) 332 – 341½
9.) ~~329~~ 331½ – 329
10.) 331½ – 345
11.) 331½ – 346
12.) 330½ – 345½
14.) 330 – 348

14.) 330 – 353½
15.) 329 – 354

Street mains 1,8 %
Feeder 10 %
Lamps 88.2
100 %

Gemeinschaft: 1' = 0.0085 5158 Ohm
1:233
5798:29' Street

346 Lamps 88,2 % = ~~0.0412715~~ Ohm (≈ 14006) 0.0364015 Ohm
4 Feeders 10 % = 0.0041271 "
Street mains 1.8 % = 0.0007429 "
100 % = 0.0412715 Ohm

Resistance of every feeder: a 0.0165084 Ohm

I = 1233·46' à 771830 circmils Nr. I
II = 2168·86' à 1357146 " " 2 à Nr. 2½
III = 3290·74' à 2059155 " " (2056177 ist 88½ in the lamp) 2 à Nr. 1½
IV 3163·94' à 1979810 " " 2 à Nr. 1½
Street mains 5798.29' tubes Nr. 4.

11/9 1888

Bridgemore.

1.) 331 – 330 Δ-1
2.) ~~326~~ 327½ – 326 Δ-1½
3.) 326½ – 327½ Δ+1½
4.) 325½ – 331 Δ+4½
5.) ~~327~~ 325½ – 326 Δ+½
7.) 325 – 331½ Δ+6½
6.) 325 – 330 Δ+5
8.) 325 – 332½ Δ+7½
9.) 325 – 327½ Δ+2½
10.) 325 – 330 Δ+5
11.) 325 – 327 Δ+2
12.) 324 – 325½ Δ+1½
13.) 324 – 326 Δ+2
14.) 324 – 330 Δ+6
15.) 324 – 330½ Δ+6½
16.) 324 – 328 Δ+4

The feeder lamp mains to the feeder I

1.) 344½ – 324½ Δ-20
2.) 345 – 321½
3.) 345 – 324
4.) 344½ – 329
5.) 345 – 324
6.) 344½ – 327½
7.) 345 – 329½
8.) 344½ – 330
9.) 344 – 325
10.) 343½ – 326
11.) 342½ – 323½
12.) 342 – 322
13.) 342 – 324½
14.) 342 – 326½
15.) 342 – 328
16.) 342 – 324½

The Milan network gets 1 thermopile for every feeder (10 Ohm resist. galvanometer).

P I 78 P II 62 P III 61 P IV 79

846 Roselle. $\lg = 0.9476909 - 1$

~~845~~ $0.8865 = 2490$ Ohm

~~840~~ Series à 750 Ohm = ~~0.8875 740~~ ~~0.8925 8574~~ Ohm

Insulation: 5 cells in series, highest.

Gals: Defl: 0

Transcripts 15 Jy 1882

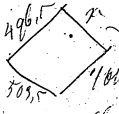
Chambers

By the wire on this network, resistance of 1 foot = 0.0177 67035 Ohm, are represented ~~339~~ 339837 circular mil of copper (lg = 5.531 2699). Ratio to nature 1:584.5. One circ mil copper = 10.33 Ohm.

Resistance of copper on G.S. wire: 1:20.434

19/9 1890

Measurements of resistance of the whole system.



2.6959193
2.7019995
0.9939198 − 1
0.9860973
0.9661261.9

Ratio of cells at terminals 0.019735 difference 0.05 means in nearly 2% of the cells.

Clarke

Without any leader between centrestation and the two farest houses on every side there was a difference of pressure between 5 – 6%; if groundconnection it would be only 2½ – 3%, sufficient for overhead wires, which cannot become hot so easy.

3 feeders: I. Measurement.

20/9 1882.

1.) 346 – 349 + 3
2.) 346 – 349 + 3
3.) 346 – 350 + 4
4.) 346 – 350 + 4
5.) 346 – 351 + 5
6.) 346 – 350 + 4
7.) 346 – 347 + 1
8.) 347 – 347 ±0
9.) 344½ – 344½
10.) 344½ – 343½ – 1
11.) 344 – 345 + 1
12.) 344 – 343 – 1
13.) 344 – 342 – 2
14.) 343½ – 343 – ½
15.) 344 – 343½ – ½
16.) 344 – 344 ±0
17.) 341½ – 341½ 0
18.) 342 – 341½ – ½
19.) 342 – 342 – 0
20.) 342 – 342½ + ½
21.) 342 – 343 + 1
22.) 342½ – 343 + ½
23.) 343 – 344½ + 1½
24.) 343 – 345 + 2
25.) 343 – 345 + 2
27.) 343 – 346 + 3
28.) 343 – 346½ + 3½

Clarke

21/9 1882. (mostly air) Middle face nearly.

~~1.) 340 – 340~~

1.) 366 – 366 = 0

2.) 364 – 364½ + ½ = +0.14%

3.) 363½ – 365 + 1½ = +0.14%

4.) 362½ – 364½ + 2 = +0.57%

5.) 362½ – 365 + 2½ = +0.69%

6.) 362 – 362½ + ½ = +0.14%

7.) 361 – 359½ – 1½ = –0.42%

8.) 360 – 358 – 2 = –0.56%

9.) 360 – 357 – 3 = –0.83%

10a) 360 – 358½ – 1½ = –0.42%

10b) 359½ – 359½ = 0

11.) 359½ – 359½ = 0

12.) 359½ – 357½ – 2 = –0.55%

13.) 359 – 356½ – 2½ = –0.69%

14.) 358½ – 357 – 1½ = –0.41%

15.) 360 – 358 – 2 = –0.55%

16.) 360 – 358½ – 1½ = –0.42%

17.) 359 – 357½ – 1½ = –0.41%

18.) 358½ – 355 – 3½ = –0.97%

19.) 358 – 357 – 1 = –0.28%

20.) 358 – 356½ – 1½ = –0.42%

21.) 357½ – 356½ – 1 = –0.28%

22.) 357 – 356 – 1 = –0.28%

23.) 356½ – 356½ = 0

24a) 356½ – 355½ – 1 = –0.28%

24b) 356 – 355 – 1 = –0.28%

24c) 355½ – 355½ = 0

25.) 355½ – 354 – 1½ = –0.42%

26.) 355 – 354 – 1 = –0.28%

27.) 355 – 356½ + 1½ = +0.42%

28.) 355 – 356½ + 1½ = +0.42%

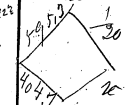
Clewring

J. Thomp

26/9 1882

Measurements of the 3 faces

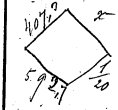
Calcul:



74°F

2.607 1332
2.774 7359

0.833 3973 – 1 = 0.679825
34
0.0399125



2.609 9144
2.772 8949

0.837 0795 – 1 = 0.687194
27
0.0743597
0.0683509
0.0341754

Pa = 0.0341754

Clewring

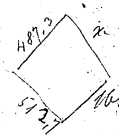
J. Thomp

27. Sept. 1882. 77°5

Whole System:

2.685 1145
2.712 3971
0.972 7174 − 1
9

4939112
950460
1889572
9446786
− 0.634175 = Ires
9910611



2.687 7964
2.709 8633
0.977 9331 − 1

Whole Resist. 0.910611

− Lampcails: 0.882574

0.023037 = Resist of thermometer

100 ° ; if 0.910611 = 88 ° : 1.0348

1½ = 0.010348

2° = 0.02 0696, therefore

above almost exactly 2°.

Readers on the same places, like 21/9 1882, page 172.

1.) 317,5 = 318+0,5
2.) 317 = 317,5 + 0,5
3.) 316,5 = 317,5 + 1
4.) 315,5 = 317 + 1½
5.) 314,5 = 317 + 2½
6.) ~~312~~ 357,5 = 957,5 = 0
7.) 354 = 352 = 2
8.) 352 = 350 = 2
9.) 351 = 348 = 3
10.) 350½ = 349 = 1½
11.) 350 = 350 = 0
12.) 349 = 349 = 0
13.) 348 = 346½ = 1½
14.) 347½ = 345 = 2½
15.) 347 = 345 = 2
16.) 346 = 344½ = 1½
17.) 345½ = 344½ = 1
18.) 344½ = 342 = 2½
19.) 344 = 342 = 2
20.) 343½ = 341½ = 2
21.) 343 = 342½ = ½
22.) 342½ = 341½ = 1
23.) 342 = 341½ = ½
24.) 341½ = 341½ = 0
25.) 341 = 340½ = ½
26.) 340½ = 340 = ½
27.) 340 = 339½ = ½
28.) 340 = 339½ = ½
29.) 340 = 341 + 1

The two outside feeders moved.

1) 934 ÷ 934 ÷ = 0
2) 935 − 935 = 0
3) 935 − 935 = 0
4) 935 − 935 = 0
5) 935 − 936 + 1
6) 935 − 936 ÷ + 1½
7) 935 − 933 − 2
8) 934 − 934 = 0
9) 934 − 934 − 1
10) 933 ÷ − 932 − 1½
10) 933 − 933 = 0
11) 933 − 933 ÷ + ½
12) 933 − 933 = 0
13) 933 − 932 − 1
14) 933 − 933 = 0
15) 933 − 933 = 0
16) 933 − 933 = 0
17) 933 − 932 ÷ − ½
18) 933 − 933 ÷ − ½
19) 933 − 932 − 1
20) 933 − 932 ÷ − 1
21) 933 − 932 ÷ − ½
22) 933 − 932 ÷ − ½
23) 933 − 933 = 0
23) 932 ÷ − 933 + ½
24) 932 ÷ − 932 − ½
24) 932 ÷ − 932 ÷ = 0
25) 932 ÷ − 932 − ½
26) 932 ÷ − 932 − ½
27) 932 ÷ − 933 ÷ + 1
28) 932 ÷ − 933 + ½

70 c p. H Kemp
A Claudin

Whole system with 2 feeders moved.

2.6869643
2.710 7586
24 = 61147 − 1 = 0.946662

2.6836470
2.7783292
Claudin
H Kemp
0.968.7172 − 1 = 0.9305

18.77164
2 0.9 26582
− Lamp poles 0.887574
0.051008
− Mines 0.034175
0.016833
Resist of street mains . . . 0.020996
2% page 174 . . . .
therefore less than 2%.

28/9 1882 Fach I mass

1) 994 x − 993 − 1 = 0.29%
2) 994 − 993 − 1 = 0.29%
3) 994 − 992½ − 1 = 0.47%
4) 994 − 992½ − 1½ = 0.44%
5) 993½ − 993 − ½ = 0.14%
6) 993 − 995 + 2 = 0.6%
7) 993 − 992 − 1 = 0.3%
8) 993 − 990½ − 2½ = 0.75%
9) 992½ − 990 − 2½ = 0.75%
10) 992 − 991 − 1 = 0.3%
11) 992 − 992 = 0
12) 992 − 991½ − ½ = 0.15%
13) 991½ − 990½ − 1 = 0.3%
14) 991 − 991 = 0 Olanda
15) 991 − 991 = 0
16) 992 − 991½ − ½ = 0.15%
17) 992 − 991 − 1 = 0.3%
18) 992 − 990½ − ½ = 0.6%
19) 991½ − 990½ − 1 = 0.3%
20) 991½ − 990½ − 1 = 0.3%
21) 991 − 991 = 0
22) 991 − 990½ − ½ = 0.15%
23) 991 − 990½ − ½ = 0.15%
24) 990½ − 990½ = 0
25) 990½ − 990½ = 0
26) 992 − 991 − 1 = 0.3%
27) 992 − 992½ + ½ = 0.15%
28) 992 − 991½ − ½ = 0.15%

Whole system 94 #

485 x 515 1 Ohm

2.6857417
2.711 8072
0.9739372 − 1 = 0.941748

517 1 Ohm 489 x

2.6839471
2.7334925
0.9704566 − 1 = 0.934236
282) 1.875984
0.937992 Ohm

517 1 ohm Ohm 489 x

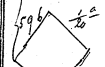
Resist

485 x 515 1 ohm Ohm

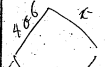
2.6857417
Olanda

3 feeders, Resistance: 74°F

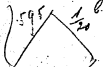
2.6079909
2.7741512
0.8338390 − 1 = 0.68208



2.6063814
2.7752463
0.8314351 − 1 = 0.67785
1.35693
2x) 0.679765



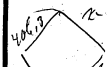
2.6085260
2.7737864
0.8347596 − 1 = 0.69950
0.68067
1.36417
2x) 0.682085



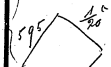
2.6074550
2.7745770
0.8329380 − 1 = 0.68067
2x) = 0.034034

Hemp

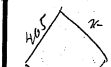
74°F

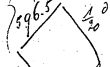


2.6088468
2.7735670
0.8352798 − 1 = 0.68435
0.68067
1.36502
2x) 0.682510



2.6074550
2.7745770
0.8329380 − 1





2.6058435
2.7756104
0.8302331 − 1 = 0.67645
0.68067
1.35712
2x) 0.67856

0.68208 − 2) 0.679965
0.69785 − 1) 0.6822085
0.68550 II) 0.6822510
0.68067 III) 0.6822510
0.68435 IV) 0.6878560
0.67645 V) 0.6780490
0.68067 0.2723920
0.68081 0.6807980
0.034042 2) 0.0340390

Hemp

Resistance of the whole system

0.937992 Ohm

systems à 750 lb. 0.887574 "

0.050418 Ohm

3 feeders . . . 0.037039 "

Streetmains 0.016279 Ohm

Clending

Length of the streetmains 273.417' × 2 = 546.28.34'

" of feeder I. 504.9' × 2 = 1009.8

" " II. 2169.6' × 2 = 4339.2

" " " III. 2320.8' × 2 = 4641.6

88 : 100 = 0.887574 : x

x = 1.0086 = 100 %

0.010086 = 1 %

0.020172 = 2 %

0.10086 = 10 %

0.30258 Ohm one feeder

Circul: mils of the feeder.

I. 34474 circ. m.

II 148139 " "

III 158463 " "

Streetmains: the german-silver wire represented 339837 circ. m.

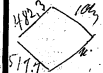
$\frac{1}{3}$ of it = 113279 circ. mils

Clending.

7/10 1889

Measurement of Duellenstreets, 4 feeders

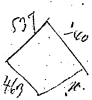
2.6839471
2.7134905
0.9704566 − 1 = 0.934236
28



2.6833173
2.7140782
0.969 2391 − 1 = 0.931621
1.865857
0.93 2924

Specimen alone 77°F

2.665 2995
2.730 2168
0.935 08 27 − 1 = 0.86 1157
2 5 6
39

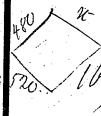


2.665 8810
2.729 9743
0.935 60 64 − 1 = 0.861497
77 1.723354
2 0.861677
0.0015419

Total 0.932928

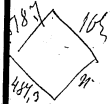
Wires 0.021542 −0.909116
Lamps 0.887574 | 0.023812
0.909116

Measurements of the whole network 185



76°F.

2.681241 2
2.736 0033
0.965 23 79 − 1 = 0.923077



2.682 4159
2.714 9162
0.967 5 995 − 1 = 0.927897
72
1.850974
0.925487

Total 0.925487
0.909116
0.016371

9/10-1882

4 feeders.

1) 422 ½ - 420 - 2½ = 0.59%
2) 422 ½ - 420 - 2½ = 0.59%
3) 422 - 421 - 1 = 0.24%
4) 422 - 421 - 1 = 0.24%
5) 422 - 422 - 0 = 0 %
6) 420 - 422½ - ½ = 0.12%
7) 421 - 421 = 0 %
8) 422 - 422½ - ½ = 0.12%
9) 423 - 422 - 1 = 0.24%
10a) 423 - 421½ - 1½ = 0.35%
10b) 422½ - 422½ = 0
11) 423½ - 420 - 3½ = 0.83%
423 - 419½ - 3½ = 0.83%
12) 423 - 417½ - 5½ = 1.30%
13) 422½ - 416 - 6½ = 1.54%
14) 423 - 417 - 6 = 1.42%
15) 423 - 417 - 6 = 1.42%
16) 422½ - 417½ - 5 = 1.18%
17) 422 - 417 - 6 = 1.42%
18) 422 - 416½ - 5½ = 1.30%
19) 425 - 420 - 5 = 1.18%
20) 424½ - 420 - 4½ = 1.06%
21) 424½ - 420½ - 4 = 0.94%
22) 424 - 420 - 4 = 0.94%
23a) 424 - 421 - 3 = 0.71%
23b) 424 - 420½ - 3½ = 0.83%
24a) 424 - 422 - 2 = 0.47%
24b) 424 - 422 - 2 = 0.47%
25) 424 - 420½ - 3½ = 0.83%
26) 424 - 420 - 4 = 0.94%
27) 424 - 422½ - 1½ = 0.35%
28) 424 - 422½ - 1½ = 0.35%

Feeders marked

1) 319½ - 318½ - 1 = 0.31%
2) 319½ - 318 - 1½ = 0.47%
3) 319 - 317½ - 1½ = 0.47%
4) 318½ - 316½ - 2 = 0.62%
5) 318½ - 317½ - 1 = 0.31%
6) 318½ - 317½ - 1 = 0.31%
7) 318 - 315½ - 2½ = 0.78%
8) 318 - 315 - 3 = 0.94%
9) 317½ - 313½ - 4 = 1.26%
10a) 317½ - 316½ - 1 = 0.31%
10b) 319 - 319 - 0 = 0 %
11) 319 - 315½ - 3½ = 1.09
12) 319 - 316½ - 2½ = 0.78%
13) 318½ - 315 - 3½ = 1.09%
14) 318½ - 315½ - 3 = 0.94%
15) 318½ - 315½ - 3 = 0.94%
16) 318½ - 315½ - 3 = 0.94%
17) 318½ - 315 - 3½ = 1.09%
18) 318½ - 314 - 4½ = 1.41%
19) 318 - 314½ - 3½ = 1.10%
20) 318 - 314½ - 3½ = 1.10%
21) 318 - 315 - 3 = 0.94%
22) 318 - 315 - 3 = 0.98%
23) 318 - 315½ - 2½ = 0.79%
24a) 317½ - 315½ - 2 = 0.63%
24b) 317½ - 316 - 1½ = 0.47%
24c) 317½ - 316½ - 1 = 0.31%
25) 317½ - 315 - 2½ = 0.79%
26) 317½ - 315½ - 2½ = 0.79%
27) 317½ - 317½ - 0 %
28) 317½ - 317½ - 0 %

10/10.1892 4 feeders one moved.

1) 949 – 944½ + 1½ = 0.44%
3) 997 – 997½ + ½ = 0.14%
5) 996½ – 998 + 1½ = 0.44%
7) 994½ – 995½ + ½ = 0.15%
9) 994½ – 993½ – 1 = 0.29%
10 a) 994½ – 994½ = 0%
12) 993½ – 993½ = 0%
14) 993½ – 993 – ½ = 0.15%
16) 993 – 992½ – ½ = 0.15%
18) 992 – 991½ – 1½ = 0.45%
20) 992½ – 992 – ½ = 0.15%
22) 992½ – 992 – ½ = 0.15%
23 b) 992 – 993½ + 1 = 0.30%
24 b) 991½ – 993 + 1½ = 0.45%
26) 991½ – 992 + ½ = 0.15%
28) ~~991½ – 994 + 2½ = 0.75%~~
991½ – 991 + 2½ = 0.75%
30 a) 992 – 990½ – 1½ = 0.45%

Dynamo running always, induction-currents, permanent effect impossible.

4 feeders ~~two~~ moved.

1) 992 – 992 = 0%
2) 992 – 992 = 0%
3) 992 – 992½ + ½ = 0.15%
4) 991½ – 992½ + 1 = 0.30
5) 991½ – 989 + 1½ = 0.45%
6) 991 – 992½ + 1½ = 0.45%
7) 991½ – 991½ = 0%
8) 991½ – 990½ – 1 = ~~0.45~~ 0.30%
9) 991½ – 990 – 1½ = 0.45%
10 b) 991 – 990 – 1 = 0.30%
10 c) 991 – 991 = 0%
11) 991 – 990 – 1 = 0.30%
12) 991 – 990½ – ½ = 0.15%
13) 991 – 990 – 1 = 0.30%
14) 991 – 990 – 1 = 0.30%
15) 990½ – 990 – ½ = 0.15%
16) 990½ – 990 – ½ = 0.15%
17) 990½ – 989 – 1½ = 0.45%
18) 990 – 988½ – 1½ = 0.45%
19) 990 – 988½ – 1½ = 0.45%
20) 990 – 989 – 1 = 0.30%
21) 990 – 990 = 0%
22) 990 – 989 – 1 = 0.30%
23 a) 990 – 990 = 0%
24) ~~990~~ 990 – 990½ + ½ = 0.15%
25) 989½ – 990 + 1 = 0.30%
26) 989½ – 989½ = 0%
27) 989½ – 990½ + 1 = 0.30%
28) 989½ – 991 + 1½ = 0.45%

Observations
MB
Lemp

846 Sonia à 750 Ohm = 0.8865249
2% = 0.0201482 92
100% = 1.0074146 | 10% = 0.100741 46
Total = 1.0674146,52

Mino-park 13th/X/82.

Being ably assisted by Mr Clubbis I have been able to step in our measurements in the "Roelli" district by getting as result nonance. Mr Clubbis heard me to double every Resistance coil and that each one of strains are short-circuited.

In the following all figures found in the spools are registered and the bad ones are changed on the board so as the letter will be entirely according with the map.

Block 3.

5 series coils (150 Ohm) is made as shows. Sketch

1)

→ one 100 Ohm coil

then two 100 Oh in multiple are respectively by the 50 Ohm and the letter in series are 150 Oh.

one of the two 100 Ohm coils joined in multiple are not found broken. the current past in through two 100 Ohm coils in series.

therefore resistance instead of 150 Ohm = 200 Ohm.

Block 5.

the same case as in block 3.
R = 200 Ohm instead of 150.

Block 4.

the same case as in block 3.
R = 200 Ohm instead of 150.

Block 9

the same case as in block 3.
R = 200 Ohm. instead of 150.

Block 14.

one street lamp coil (750 Ohm) mentioned on the map not put on the board.
Resistance in this place therefore raised to ∞. 750. 0 = ∞.

Block 25.

one 5 serie lamp coil
150 Ohm represented in one single coil and not in three ~~[illegible]~~ sometimes right
therefore probably wire broken inside.
Res = ∞ instead of 150 Ohm.

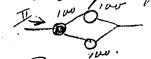
Block 30.

1) the same case as in block 3.
R = 200 Ohm instead of 150.

2). one of the street lamp coils (750 Ohm) sometimes right
" " no current.
R = ∞ instead of 750.

Block 33.

1) one of the three 100 Ohm coils stream-less and because it's the, as shown sketch II no current at all passing through the 3 coils.



R = ∞ instead of 750.

2) ~~Block~~ same case as in block 3.
therefore R = 200 Ohm instead of 150.

Block 36.

same case as in block 3.
R = 200 O. instead of 150

Block 34

same case as in block 3.
R = 200 O. instead of 150.

In our calculations.
the joint Resistence of 845 series
was taken = 0,887574 .... ohm.
of this 845 series
only 793. correct.
12 series no current
and 8. 150 ohm coils = 200 ohm
so we had a resistance =

$$= \frac{\frac{750}{793} \cdot \frac{200}{8}}{\frac{750}{793} + \frac{200}{8}} = 0,9113 \text{ ohm}$$

right R. 0,887574.
bad R. 0,9113
diff. 0,023726 ohm

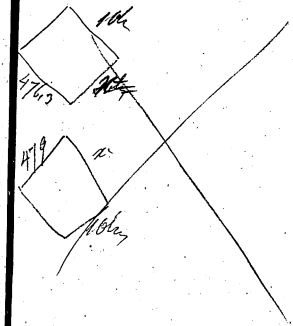
The mistake that one streetlamp was not put on the board, but was counted as with the 845 series so that we have now 846 series.

All corrections are now done and I testify that every lamp gets its coils they have to have according to the map and that all coils are correct on 14 °/oo

Hermann Cohn

18/10 1887

Measurement of the whole network.
76½ °/o



Measurement of the 4 feeders alone. 78° F.

2.7062910
2.6915250
0.0147660
0.3295938-2 = 0.4043693-2
= 0.0245244
½ = 0.3495938-2
347
66

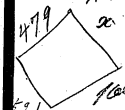
40 = ?

2.7037212
2.6946663
0.0090549
0.3895938-2 = 0.0257824
0.3991487-2 = 0.0250697
1728
117
0.0050421
2) 0.0252260 = 78°

= 0.0249796 Ohm à 78° C.
0.8865249
0.9115045

0.0249796
0.8904888
0.915447 = at 78° C.

Whole network open 4 feeders.



78° C.

0.0017175
2.6803355
0.0044448
2.6846503
2.7068377
0.0965212-1
0.0965212-1
0.0017175
2.6746076
0.0042448
2.6788524
2.7068377
2.7109901
0.0958793-1
0.0965212-1
0.0006419
0.0044
0.0975025
2) 0.0975012

0.923029
0.0017175
2.6776076
0.0042448
2.6818524
2.7109901
0.0911996

= 0.928566
0.917467
1.846033
2) 0.923016 = at 78°
0.915045
0.917512
0.0002065 Ohm
0.923016
0.915447
0.007569 Ohm
0.923016
0.915447
0.007569

Office 1889

Table readments 4 feeders

477.3 x — 520.7 Table

2.680 6074
2.776 5876
0.968 0198-1 = 0.920492
= 1.003611
g. = 0.0015843

0.912046
1.833538
0.916269 g.

523 Table — 477 x

2.6785184
2.7185017
0.960016 7-1
21 = 0.919628

g = 0.962 0250 - 1
0.001 5843
0.963 6073 - 1

2 feeders, 1880

481.7 x — 518.3 Table

2.6827766
2.714 5912
0.968 1954-1
0.001 7875
0.969 9129-1 = 0.933067
0.926
33

0.924880
1.857947
0.928673 -1

520.5 Table — 479.5 x

2.680 7886
2.716 4207
0.964 3679-1
0.001 7175
0.966 0854-1

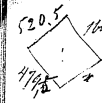
3 feeders, old places page 178

1) 326½ − 326 − ½ = 0.15 g
2) 326½ − 325½ − 1 = 0.30 g
3) 326½ − 325 − 1½ = 0.45 g
4) 326½ − 325 − 1½ = 0.45 g
5) 326 − 325½ − ½ = 0.15 g
6) 326 − 324½ − 1½ = 0.45 g
7) 325½ − 324 − 1½ = 0.45 g
8) 325 − 323 − 2 = 0.60 g
9) 325 − 322½ − 2½ = 0.75 g
10) 326½ − 325 − 1½ = 0.45 g
11) 326½ − 326½ = 0 g
12) 326 − 326 = 0 g
13) 326 − 326 = 0 g
14) 325½ − 325½ = 0.15 g
15) 325 − 325 = 0 g

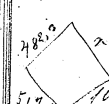
16) 325 − 324 − 1 = 0.30
17) 325 − 323 − 2 = 0.60
18) 325 − 323½ − 1½ = 0.45 g
19) 325 − 323½ − 1½ = 0.45 g
20) 324½ − 323 − 1½ = 0.45 g
21) 324½ − 324 − ½ = 0.15 g
22) 324 − 323½ − ½ = 0.15 g
23) 323½ − 323½ = 0 g
24) 323½ − 323½ = 0.15 g
25) 323 − 323 = 0 g
26) 323 − 322 − 1 = 0.30 g
27) 322½ − 323 + ½ = 0.15 g
28) 322½ − 322½ = 0 g

Measurement of outside system

3 feeders 82°F.

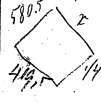


520.5 — 1669 = 0.0020501
2.6707886
2.7164207
0.969.367 — 0.921229
0.931621
7.555880
0.926425

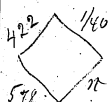


488.3 — 517.7
2.6893979
2.7140782
0.9692391-1 — 0.9668102
0.020501
0.9688603
= 0.930809 Ohm at 82°F

Coils at 82° = ~~0.888655~~ = 0.899720
3 feeders alone = 0.934581
at 82°F.



580.5 — 440
2.7638022
2.622.7930
0.141.0792 = 1.383790
1.3668
2.775458
1.3767 = q
q = 0.1388434



422 — 578
2.7619278
2.6257927
0.136.6159
at 82° = 0.0345581

System 0.930809 Coils 0.899720
— 0.925301 3 feeders 0.034581
Street mains 0.005508 0.925301

98% Coils = ~~0.949~~ 0.899720
2% Street mains 0.020243
10% Feeders - 0.101288
1.041187 = 100%

found by calculation 2% = 0.020243
" " measurement
2% = 0.005508×3 = 0.016524

Check ins

At 60°F:

Resists of the Lamps (246 Series 2750 Ohm), 88% = 0.8865249 Ohm
3 Feeders . . . . . = 10% = 0.1007414 "
Street mains . . . . = 2% = 0.0201482 "
100% = 1.0074145 Ohm

One feeder therefore: 0.3022242 Ohm

feeder I 504.9×2 = 1009.8' = 34515 circ.m. = 2200 = 10 wires
" II 2169.662 = 4339.2' = 148314 " = 7-8 " 10 "
" III 2320.84 = 4641.6' = 158649 " = 8 " 10 "
Street mains 27314.17×2 = 54628.34' = 1132779 " = 6 " 10 "

I = 109.64 - 164.46 R.
II = 469.06 - 1804.648
III 206 R

Total weight
Street mains 17794.62 R 21569.32 - 21859.28
2 26. $5608.03 - $5685.15. 2 18. $3882.48 - $3938.77.

Meriloparb 17/10 1882.

Yesterday I was informed by Dr Lemy that he had cut out at 5, but 7' wire for electrical measurement of the needle network. Therefore I represents not 339837, but 475.771 division-marks. I informed today Dr Marx. Dr Lemy about the matter and new measurement will be made with 4 feeder.

Claudius

Measurement with 4 feeder, 18/10 1882.

1/362,5 − 362+½ = 0.14%
2/362,5 − 362+½ = 0.14%
3/362,5 − 362+½ = 0.14%
4/362,5 − 362+½ = 0.14%
5/362,5 − 362+½ = 0.14%
6/362,5 − 362,5+2 = 0.55%
7/362,5 − 362,5+2 = 0.55%
8/362,5 − 362+½ = 0.14%
9/362,5 − 362,5 = 0%
10/362,5 − 362+½ = 0.14%
11/362,5 − 362,5 = 0%
12/362,5 − 362,5 − 1 = 0.28%
13/362,5 − 362+½ = 0.14%
14/362 − 362+½ = 0.14%
15/362 − 362+½ = 0.14%
16/362 − 362 − 1 = 0.28%
17/362 − 362 − 2 = 0.56%
18/362,5 − 362 − 2½ = 0.70%
19/362,5 − 362,5 − 2 = 0.55%
20/362,5 − 362,5 − 2 = 0.55%
21/362 − 362+½ = 0.14%
22/362 − 362+½ = 0.14%
23/362 − 362 = 0%
24/362 − 362+½ = 0%
25/362 − 362+½ = 0.14%
26/362 − 362 − 1 = 0.28%
27/362 − 362 = 0%
28/362,5 − 362+½ = 0.14%

Claudius

4 (either all moved or not at all)

1) 360 − 358.5 − 1½ = 0.14%
2) 360 − 358 − 1½ = 0.14%
3) 360 − 358.5 − 1½ = 0.14%
4) 360 − 358.5 − 1½ = 0.14%
5) 360 − 358.5 − 1½ = 0.14%
6) 360 − 360 − 0%
7) 360 − 359 − 1 = 0.28%
8) 360 − 358 − 2 = 0.56%
9) 360 − 357½ − 2½ = 0.68%
10) 360 − 358½ − 1½ = 0.42%
11) 359.5 − 359.5 = 0%
12) 359.5 − 358 − 1½ = 0.41%
13) 359.5 − 356 − 3½ = 0.97%
14) 359 − 355 − 4 = 1.1%
15) 359 − 355 − 4 = 1.1%

Feeder I moved:

16) 359 − 356½ − 2½ = 0.69
17) 359 − 356½ − 2½ = 0.69
18) 359 − 357½ − 1½ = 0.41%

Feeder I moved.

19) 359 − 357½ − 1½ = 0.41%
20) 357.5 − 357 − ½ = 0.14%
21) 357.5 − 356 − 1½ = 0.41%
22) 357.5 − 357.5 = 0%
23) 357.5 − 357.5 = 0%
24) 357.5 − 357 + ½ = 0.14%
25) 357½ − 357 − ½ = 0.14
26) 357½ − 356 − 1½ = 0.42%
27) 357½ − 357½ = 0%
28) 357 − 357½ + ½ = 0.14%
29) 357 − 357½ + ½ = 0.14%

Clemens

Jaggy method, at a time, changed a little

19/10 1882. The same later the test to Hutton.

1) 362.5 − 362 − ½ = 0.14%
2) 362.5 − 362 − ½ = 0.14%
3) 362 − 361½ − ½ = 0.14%
4) 362 − 361½ − ½ = 0.14%
5) 361½ − 362 + ½ = 0.14%
6) 361½ − 362 + 1 = 0.28%
7) 362 − 361 + ½ = 0.14%
8) 362 − 360 − 2 = 0.55%
9) 362 − 359½ − 2½ = 0.69%
10) 362 − 359 − 3 = 0.83%
11) 359.5 − 359½ = 0%
12) 359.5 − 359½ − 0 = 0%
13) 359.5 − 359 − ½ = 0.14%
14) 359 − 358 − 1 = 0.28%
15) 359 − 358 − 1 = 0.28%
16) 359½ − 358½ − 1 = 0.28%
17) 359½ − 358½ + 1 = 0.28%
18) 359½ − 358½ = 0%
19) 358 − 357 − 1 = 0.28%
20) 357½ − 358½ − 1 = 0.28%
21) 357½ − 358½ − 1 = 0.28%
22) 357½ − 358½ − 1½ = 0.42%
23) 357½ − 357½ = 0%
24) 357½ − 357½ = 0%
25) 357½ − 357½ = 0%
26) 357 − 357½ + ½ = 0.14%
27) 356½ − 357½ + 1 = 0.28%
28) 357½ − 357½ = 0%
29) 357½ − 357½ = 0.14%
30) 357½ − 357½ − ½ = 0.14%
31) 357½ − 356½ − 1 = 0.28%
32) 357½ − 356½ − 1 = 0.28%
33) 358 − 356 (?)
34) 358 − 357½ − ½ = 0.14%
35) 358½ − 357½ − ½ = 0.14%
36) 358½ − 356½ − 2 = 0.56%

Clemens

Jaggy method, changing

The measurement of the system and feeders today gave a negative result without due to the moisty air, so that whole the system was to have against feeders

With 3 feeders we have 1,65 % and that would be 2,2 % loss in the street mains with ~~[illegible]~~ = 339837/3 circular mils, because ratio is not more: 3, but 1:4

Every feeder has resist: 0,402 96 ohm

Length of feeders: I 730'×2 = 1460' = 36914 c.m.

II 1550'×2 = 3100' = 79468 " "

III 2907'×2 = 5814' = 149042 " "

IV 2010'×2 = 4020' = 103053 " "

Street mains length 27134'×2 = 54268'

I = 2) 10 = 10
II = 4 " 10
III = 8 " 10
IV 5 " 10
} 3754,2 ℔

Street mains 6 = 1176 773 ℔

St. Jago di Chile.

1609 Lacuna à 140 Ohms resistance.

1' German silver wire (also small wire of 5 Ohm I-Ohm)

0.0121884 Ohm resist.

Table No. 3 has one cupon 262,957 circ. mils

and 0.0000392849 Ohms per foot

therefore ratio between resistance of

Germ. silver wire and nickel table No. 3:

$$\frac{0.0121884}{0.0000392849} = 310,05$$

1 : 310

Measurements in insulation 6/11 1882.

Very good, no collection noted

high resist. Gals. and Frelli. Chundy.

0/11 1882. 2 Factors.

1) 336 − 357 + 21 = 6,2%
2) 334 − 370 + 36 = 10,8%
3) 332 − 368 + 36 = — / 352 − 345 − 339 − 351 − 4

I

1) 341 − 347 + 6 = 1,4%
2) 340 − 337,5 − 2,5 = 0,74%
3) 339 − 337,5 − 1,5 = 0,44%
4) 339 − 334 − 5 = 1,5%
5) 339 − 331 − 8 = 2,4%
6) 338 − 331 − 7 = 2,07%
7) 338 − 330 − 8 = 2,37%
8) 338 − 332 − 6 = 1,8%
9) 338 − 330 − 8 = 2,37%
10) 338 − 330 − 8 = 2,37%
11) 338 − 337,5 − ½ = 0,15%
12) 338 − 337 − 1 = 0,29%
13) 338 − 347 + 9 = 2,7%
14) 338 − 333,5 − 4,5 = 1,33%
15) 338 − 345 + 7,5 = 2,2%
16) 337,5 − 344 + 6,5 = 1,9%
17) 338 − 324 − 14 = 4,1%
18) 338 − 334 − 4 = 1,19%
19) 338 − 326 − 12 = 3,5%
20) 338 − 331 − 7 = 2,07%
21) 338 − 331,5 − 6½ = 1,9%
22) 338 − 338 − 0%
23) 338 − 336½ − 1½ = 0,43%

10/11 1882. 2 Factors, one moved. 243

11/11 1882. 2 Factors on the det. plane.
Measurement for contact:

1) 368½ − 371 + 2½ = 2,5%
5) 445 − 411 − 34 = 6,7%
7) 357,5 − 348 − 9½ = 2,8%
5) 356 − 347,5 − 8½ = 2,4%
14) 356 − 341 − 15 = 4,2%
19) 356 − 342,5 = 13,5%

13/11 1882. 2 Factors, one moved.

1) 375 − 385 + 10 = 2,6%
2) 374 − 366 − 8 = 2,1%
7) 373 − 392 + 19 = 5,1%
17) 372,5 − 356 − 16,5 = —

3 Feebers

1.) 372 - 372 = 0%

2.) 372 -

3 Feebers - 2 new bridges

1.) 362 - 358 - 4 = 1.1%

2.) 362 - 359 - 3 = 0.55%

7.) 362 - 355,5 - 9,5 = 2.6%

17.) 361,5 - 346 - 15,5 = 4.2%

20.) 361 - 354 - 7 = 1.9%

3 Feebers one bridge more.

21.) 362 - 355 - 7 = 1,5%

17.) 362 - 347 = 15

3 Feebers one month

17.) 348 - 344,5 + 3,5 = 1%

21.) 348 - 341 - 7 = 2%

7.) 347,5 - 342,5 + 5 = 1,4%

1.) 349 - 350 + 1 = 0,3%

2.) 345 - 362 + 15 = 4,3%

3.) 345 - 362 + 15 = 4,3%

4.) 345 - 353 + 8 = 2,1%

5.) 345 - 353 + 8 = 2,1%

6.) 345 - 350 + 5 = 1,4%

9.) 345 - 350 + 5 = 1,4%

6.) 345 - 352,5 + 7,5 = 2,1%

7.) 345 - 355 + 10 = 2,9%

10.) 345 - 352,5 + 7,5 = 2,1%

11.) 345 - 359 + 14 = 4,1%

12.) 344 - 359 + 15 = 4,3%

13.) 344 - 359 + 15 = 4,3%

14.) 344 - 349 + 5 = 1,4%

15.) 344 - 346 + 2 = 0,6%

16.) 344 - 346 + 2 = 0,6%

17.) 343,5 - 347,5 + 4 = 1,1%

18.) 343,5 - 350 + 6,5 = 1,8%

19.) 343,5 - 348 + 4,5 = 1,3%

20.) 343,5 - 353,5 + 10 = 2,9%

21.) 343,5 - 337 - 6,5 = 1,8%

22.) 343,5 - 343,5 = 0%

23.) 343,5 - 342 - 1½ = 0,4%

3 feebers one month.

23.) 359 - 356 - 3 = 0,8%

21.) 359 - 350 - 9 = 2,5%

12.) 358 - 357 - 1 = 0,3%

17.) 358 - 344 - 14 = 4,0%

Electors, one month, on both days.

1.) 333 – 333 = 0%
2.) 332,5 – 326,5 – 6 = 1.8%
3.) 331 – 335 + 4 = 1.2%
4.) 330 – 335 + 5 = 1.5%
5.) 330 – 328 – 2 = 0.6%
6.) 328,5 – 327,5 – 1 = 0.3%
7.) 328 – 325 – 3 = 0.9%
8.) 327,5 – 324 – 3,5 = 1.1%
9.) 327 – 325 – 2 = 0.6%
10.) 326 – 327½ + 1½ = 0.5%
11.) 325 – 324 – 1 = 0.3%
12.) 325 – 329,5 + 4,5 = 1.4%
13.) 324 – 329 + 5 = 1.5%
14.) 324 – 327 + 3 = 0.9%
15.) 322,5 – 330 – 7,5 = 2.3%
16.) 322 – 317 – 5 = 1.5%
17.) 322 – 317 – 5 = 1.5%
18.) 322 – 316,5 – 5½ = 1.7%
19.) 321 – 320 – 1 = 0.3%
20.) 321 – 316 – 5 = 1.5%
21.) 320 – 322 + 2 = 0.6%
22.) 320 – 314 – 6 = 1.8%
23.) 320 – 320 = 0%
24.) 320 – 317,5 – 2,5 = 0.8%

Electors, increase since

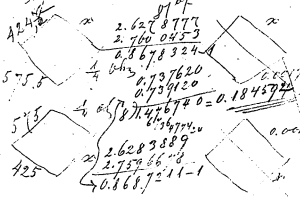
21.) 325 – 323,5 – 1½ = 0.5%
22.) 325 – 318 – 7 = 2.1%
23.) 325 – 327 + 2 = 0.6%
24.) One [illegible]

18.) 320 – 325 + 5 = 1.5%
19.) 320 – 320 = 0%
20.) 319,5 – 317 – 2,5 = 0.8%
21.) 319 – 317 – 2 = 0.6%
22.) 318 – 316 – 2 = 0.6%

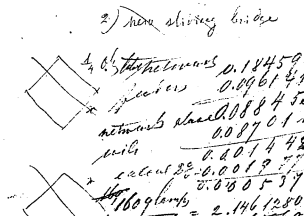
15/11 1882. Revisition at the last meeting — from yesterday:

1.) 335 – 334 – 1 = 0.3%
2.) 334,5 – 339 + 4,5 = 1.3%
3.) 334,5 – 339 + 4,5 = 1.3%
4.) 333,5 – 335 + 1,5 = 0.4%
5.) 333 – 335 + 2 = 0.6%
6.) 333 – 332 – 1 = 0.3%
7.) 332 – 332 = 0%
8.) 332 – 333 + 1 = 0.3%
9.) 331,5 – 335 + 3,5 = 1.0%
10.) 331 – 332,5 + 1½ = 0.4%
11.) 330,5 – 335,5 + 5 = 1.5%
12.) 330 – 335 + 5 = 1.5%
13.) 330 – 332 + 2 = 0.6%
14.) 330 – 330 = 0%
15.) 329,5 – 327 – 2,5 = 0.7%
16.) 329 – 327 – 2 = 0.6%
17.) 329 – 329 = 0%
18.) 328 – 329 + 1 = 0.3%
19.) 328 – 329,5 + 1,5 = 0.4%
20.) 328 – 335 + 7 = 2.1%
21.) 327 – 326 – 1 = 0.3%
22.) 327 – 327 = 0%
23.) 327 – 325 – 2 = 0.6%

Measurement of the whole system. 1) Old sliding bridge:

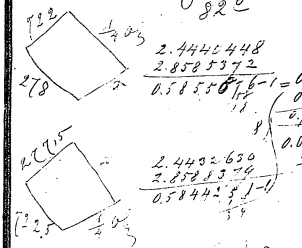


2) New sliding bridge

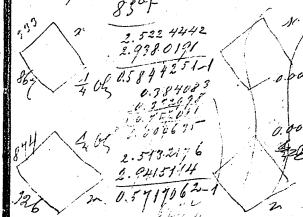


3 Feeders alone.

1) Old sliding bridge. 82°



2.) New sliding bridge. 85°F



88% lamps (1600) .... 0.087011 Ohm
2% directrices ... 0.001978
10% tubes ... 0.009886
100% = 0.098876 Ohm

Not reduced temperature!
Measurement by the sliding bridge:
Total system: 0.184594 Ohm

1600 lam.: à 40 Ohm = 0.087011
3 feeders ... = 0.096141 — 0.183152 "
for directrices remain: 0.001442 Ohm

allowed as test 2%: 0.001978 Ohm
in reality: 0.001442 "
excess: 0.000536 Ohm
or 37% instead of the required 20%

Resistance of one feeder 0.029661 Ohm
5707.65
$ 5707.65
250 65
for 52 + 20' = 1040' à 270 ... 6078.45
Not (for distribution $7.) + 10% 607.84
$ 6686.31

tube I 288'×2 = 576' = 200603 circ. mils } 1600 lamps
" II 492'×2 = 984' = 342697 " " }
" III 873'×2 = 1746' = 608078 " "
(Remark: 253 for circular mils)
For 2000 lamps:
feeder I. 288 à $0.80 = $ 230.40
15 boxes à $5 ... 75.—
$ 305.40.
Not: 3 tubes (+10%)
tube II. 492 à $1.50 = $ 738.—
25 boxes à $5 ... 125.—
" 863.—
Not: 2¾ tube (+8%) 1964.25
(less $2.25)
feeder III ~~1746~~ 873' à $1.25 = $ ~~1181.05~~ 2184.25
44 boxes à $5 ... 220.—
~~1835.05~~
Not: 2½ tube (+10%)
(less $2.73)
Directrices 1975 à $0.80 = $ 1580.—
Under
Not: 3 tube 80 boxes à $5 = 400.—
2075.—
(for $2.)
Extra boxes on corners 22 à $5 ... 110.—
$ ~~5188.45~~ 5537.65
Total
Limit $ 8000.— at Dell-Vista
Cost ~~6686.31~~ $ ~~5707.65~~
Profit $ ~~1313.69~~ = lessons learned 250.—
$ ~~5707.65~~ 5797.65

Resistances corrected to 81½°F.

Coils 0.087413 Ohms
3 feeders 0.096584 "
0.183997 Ohms

Total system = 0.185446 Ohms
substracted 3 feeders and coils = 0.183997 "
remain for street mains = 0.001449 Ohms
at that corrected temperat. = 0.001442 "
Difference 0.000007 Ohms

therefore all right.
Manchesterstr. Hornberg 16th 1882
Dorman Cambridge.

Taken 2000 Lamps:
2000 Lamps à 140 Ohms 88% = 0.070000 Ohms
2% = 0.001591 "
10% = 0.007954 "
100% = 0.079545 Ohms

One feeder therefore 0.023862 Ohm resist.

feeder I 576' = ~~266266~~ 249354 (249354) resistance
" II 934' = ~~444096~~ 425976 " "
" III 1746' = ~~806614~~ 755854 " "
} 2000 lamps

2% with 2000 lamps = 0.001591 Ohms
in reality " = 0.001442 "
excess = 0.000149 Ohms
= 10.3% of the 2000 lamps

But we must consider street mains only for 1609 lamps with 2% = 0.001928
and we have an excess pass 2% of 37%
Feeders are calculated for 2000 lamps.

Genehin

Fritz.

New prices of tubes etc.

Lucia I 288' à $1.— ... $288.—
No. 3 tube
15 boxes à $3 — ... 45.— ... $333.—

Lucia II 492' à $1.45 ... $713.40
No. 2½ tube
25 boxes à $3 — ... 75.— ... 788.40

Lucia III 873' à $2.35 ... $2051.55
No. 2 tube
42 boxes à $3. ... 132.— ... 2183.55

Strachmains 1975' à $1. ... $1975.—
No. 3 tube
99 boxes à $3 — ... 297.— ... 2272.—
Extra boxes for corners 22 à $3 ... 66.—
Service boxes 52 à $3 — ... 156.—
Tubes No. 2. 52 x 20' = 1040' à $.25 ... 260.—
$ 6058.95
+ 10% ... 605.89
$ 6664.84

Limit $ 8000.—
— 6664.84.
saved $ 1335.16

All tubes galvanized:

Lucia I now 288' à 9.95 = $28.51.
" II " 492' à 17.25 = 84.87
" III " 873' à 22c = 192.06
Strachmains 1975' à 9.95 = 195.53 ... $ 500.97

highest prices on price list—

Lucia II 492' à 12c now ... $ 59.04
" III 873' à 22c " ... 192.06 ... 251.10
$ 752.07
page 254 ... 6058.95
$ 6811.02
+10% 681.10
$ 7492.12

Limit $ 8000.—
— 7492.12
saved $ 507.88

Highest prices, not galvanized $ 6310.05
+ 10% 631.—
$ 6941.05

Limit $ 8000.
— 6941.05
saved $ 1058.95

New prices for this table, not galvanized:

Tubes I and boxes $ 933. —.
" II " " " 847.44
" III " " " 2375.61
Specimens and boxes " 22[illegible]. —
6 extra and Service boxes = 222. —
Tubes No. [illegible] 260. —

Σ $ 6[illegible]. 05
+ 10% 631. —
Σ $ 6941. 05

Limit $ 8000. —
− 6941.05
Saved $ 1058.95.

1844 Lamp à ~~[illegible]~~ 217 Ohm, three wire system
1 foot of German silver wire, annealed, =
0.013571 Ohm D = 0.1075"
ratio with nature = 1 : 250
represents boiler 190346 cubic mils
G.P. No. 2 = 66573 cubic mils
" " 3 = 67081 "
$\frac{190346}{3}$ = 63[illegible] cubic mils
Reading of galvanometer therefore 3% amps
1% in nature, consuming size of wire.
Coil of metrique represent 140 Ohm, in series
280 Ohm, in nature 208 × 2 = 416 Ohm
1% =
Reading of galvanometer 1.48 or 1.5% in nature
Therefore: wire 3 : 1
Amps 1 : $1\frac{1}{2}$
Energy 3 : $1\frac{1}{2}$ or 1 : $\frac{1}{2}$
$\frac{1}{2}$% reading = 1% in ~~nature~~.

Lamps connected:
upper wire
lower wire } total 217 Ohm

Measurement of Branch 21st 1883

258

12 feet.

Pile upper 240 } with whole Stn
Lower 245,5 } network

1st 240 – 241,5
245,5 – 247,5

1b 240 – 242
245,5 – 246

2 246 – 242
246 – 247,5

3. 240,5 – 242,5
247 – 248,5

4. 241 – 242
247,5 – 248,5

5. 241,5 – 242,5
248 – 248,5

6 242 – 243
248,5 – 249

7 242,5 – 242
249 – 248,5

8 242,5 – 241
249,5 – 248,5

9. 243 – 241,5
250 – 248

10. 243,5 – 242,5
250,5 – 248

11. 244 – 242,5
251 – 251,5

12. 245 – 244,5
252 – 248

13 245,5 – 244
252,5 – 252,5

14 246 – 242,5
253 – 252,5

15. 246,5 – 246,5
253,5 – 253,5

16. 247 – 244,5
253,5 – 253,5

17. 247,5 – 245,5
254 – 252,5

18. 247,5 – 246,5
254,5 – 253

19. 248 – 246,5
255 – 253,5

20. 248,5 – 247,5
255,5 – 255

21. 248,5 – 246,5
255,5 – 258

22. 249 – 248
256 – 258

23. 249 – 248,5
256 – 258

24. 249,5 – 249
256,5 – 255,5

259

25. 249,5 – 246
256 – 257,5

26. 182,5 – 178
188,5 – 188

March 22nd 1883, Measured 25 lamps near station 25 from upper mile and connected to lower mile Feeders. Should be cut at all planes but feeder. 12 mas. measured ∓ 8 inches to left and mark planes at all planes, again may under.

Pile upper 249
Lower 257,1

Measurement begun with station 26, pile Abercrom siding, not going down, hence lower appears.

1 e vigin 261,5 − 262,5Δ + 1 = + 0.38 ‰
Ibum 250 − 250

1 E 260.5 − 262,5Δ + 2 = + 0.77 ‰
250 − 250

2. 260,5 − 262Δ + 1,5 = 0.57 ‰
249,5 − 250Δ + 0,5 = 0.20 ‰

3. 260 − 261.5 Δ + 1.5 = + 0.58 ‰
249 − 250,5 Δ + 1.5 = + 0.60 ‰

4. 259 − 260Δ + 1 = + 0.38 ‰
248.5 − 249,5Δ + 1 = + 0.40 ‰

5. 258.5 − 259.5Δ + 1 = + 0.38 ‰
247.5 − 248 Δ + 0.5 = + 0.20 ‰

6 257.5 − 258.5 Δ + 1 = + 0.39 ‰
246,5 − 247.5 Δ + 1 = + 0.40 ‰

7. 257,5 − 257 Δ − 0.5 = − 0.19 ‰
246,5 − 246 Δ − 0.5 = − 0.20 ‰

8. 256.5 − 254.5Δ − 2 = − 0.78 ‰
245,5 − 245,5

9. 255,5 − 253.5 Δ − 2 = − 0.78 ‰
245 − 243,5 Δ − 1.5 = − 0.61 ‰

10. 255 − 253.5 Δ − 1,5 = − 0.58 ‰
245 − 242 Δ − 3 = − 1.22 ‰

11. 255 − 253.5 Δ − 1.5 = 0.58 ‰
244 − 244,5 Δ + 0.5 = + 0.20 ‰

12. 254,5 − 254 Δ − 0.5 = − 0.19 ‰
244 − 240.5 Δ − 3,5 = − 1.43 ‰

13 253,5 − 252.5 Δ − 1 = − 0.39 ‰
243,5 − 243,5

14. 253 − 249,5 Δ − 3.5 = − 1.38 ‰
242,5 − 242,5

15. 252,5 − 252,5
242,5 − 242,5

16. 252,5 − 249,5 Δ − 3 = − 1.19 ‰
242 − 241 Δ − 1 = − 0.41 ‰

17. 251,5 − 250 Δ − 1,5 = − 0.59 %
251,5 − 240 Δ − 1,5 = − 0.62 %

18. 251,5 − 250 Δ − 1,5 = − 0.59 %
241 − 240 Δ − 1 = − 0.41 %

19. 252,5 − 248,5 Δ − 2 = − 0.79 %
240,5 − 239,5 Δ − 1 = − 0.41 %

20. 250 − 251,5 Δ + 1,5 = + 0.60 %
240 − 239,5 Δ − 0,5 = − 0.21 %

21. 249,5 − 247,5 Δ − 2 = − 0.80 %
239,5 − 242 Δ + 2,5 = + 1.04 %

22. 249 − 248 Δ − 1 = − 0.40 %
238 − 240,5 Δ + 1,5 = + 0.62 %

23. 248,5 − 245,5 ———
238,5 − 240 Δ + 1,5 = + 0.62 %

24. 248 − 250 Δ + 2 = + 0.82 %
238 − 236,5 Δ − 3,5 = − 1.47 %

25. 247,5 − 247,5 ———
237,5 − 237,5 Δ − 7 = − 1.56 %

26 247,5 − 245,5 Δ − 2 = − 0.81 %
237,5 − 235 Δ − 2,5 = − 1.05 %
Results 24th 1883
Faces 12 planes at 60 plane.

26. 207,5 − 205 Δ − 2,5 = − 1.20 %
203 − 200 Δ − 3 = − 1.45 %

25. 209 − 209 ———
204 − 202 Δ − 2 = − 0.98 %

24 209,5 − 211,5 Δ + 2 = + 0.95 %
204,5 − 202 Δ − 2,5 = − 1.22 %

14 211 − 207,5 Δ − 3,5 = − 1.66 %
206,5 − 203 ———

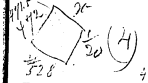
The greatest loss is at station 14 = 1,65 % or taken the mean of any 2 stations about 1,5 %, in station 3 %.

To get 2 % we must increase settlement mean of carriage from 6,3448 to 2 : 3 = 6.5448 ft. (by Table = 9122 c.m.)
x = 95175 circumferential equal
To do 0 @ 9 (105534 circ. mils)
" 1 " 3 (pounds)

Continuation of Shunting Special Book.

5 feet long samples of Bonner Silver-Mines for mechanics.

Roll X. D = 0.135"



472 = 2 · 6 · 59 · 4 · 20

528 = 2 · 2 · 2 · 3 · 3 · 3 · 11

130 891 − 1 = 0.0893940

0.0892248

0.0178608

471.5 = 2 · 6 · 3 · 7 · 8 · 7

528.5 = 3 · 2 · 3 · 7 · 4 · 5

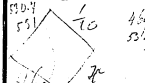
124 367 − 1 = 0.0089274

0.0089274

0.0089274 − 3

f = 0.9508728 − 3

Roll IX D = 0.135"



469 = 2 · 5 · 7 · 19 · 8

551 = 2 · 7 · 5 · 5 · 6 · 6 · 5

176 872 − 1 = 0.0088240

0.0088240

0.0176544

0.0088272

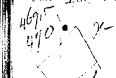
469.3 = 2 · 6 · 7 · 4 · 5 · 6

550.7 = 2 · 5 · 5 · 4 · 4 · 1

176 601 − 1

f = 0.9463403 − 3

Экс. XIII. $D = 0.133''$

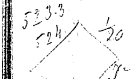


$490 = 2 \cdot 6720979$
$530 = 2 \cdot 7242759$
$\overline{.9478220} - 1 = 0.0886793$
$0.088504''$

$469.5 = 2 \cdot 6716356$
$530.5 = 2 \cdot 7246857$
$\overline{.9463502} - 1 = 0.0088503$

$\rho = 0.9473862 - 3$

Экс. XIII. $D = 0.1325''$

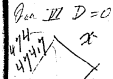


$476 = 2 \cdot 6776070$
$524 = 2 \cdot 7193513$
$\overline{.958} = 7.5 - 7 = 0.0908397$
$0.090909 = 0$
$1619 = 54$

$476.7 = 2 \cdot 6782452$
$523.3 = 2 \cdot 7187507$
$\overline{.9594959} - 1 = 0.009095 - 3$

$\rho = 0.9 = 88853 - 3$

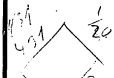
Экс. III $D = 0.132''$



$479 = 2 \cdot 6809723$
$526 = 2 \cdot 7209857$
$\overline{.9619926} - 1 = 0.0901140$
0.0903672
$180481 2$

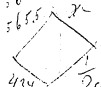
$474.7 = 2 \cdot 6761419$
$523.3 = 2 \cdot 7190407$
$\overline{.9561818} - 1 = 0.0091136$
$\rho = 0.9 = 4020 - 3$

Экс. IV $D = 0.110''$



$569 = 2 \cdot 7551423$
$451 = 2 \cdot 6377473$
$\overline{.1173950} = 0.0132018 - 7$

Rule IV D = 0.110"

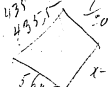


565.5 = 2.752 4700
434.7 = 2.638 1896
.1140804 = 0.1300467
0.1301495
D = 0.01931

565.5 = 2.752 4326
434.5 = 2.637 9898
.1144428 = 0.1300966 = IV

f = 0.1132659 − 2

Rule III D = 0.110"

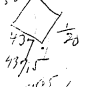


565 = 2.752 0484
435 = 2.638 4593
.1135891 = 0.1208050
0.1208212
D = 0.01293 = III

565.5 = 2.751 6639
435.5 = 2.638 9082
.1127557

f = 0.113 1177 − 2

Rule II D = 0.111"

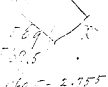


563 = 2.750 5604
437 = 2.640 4614
.1100990 = 0.1288350
0.1285714

562.5 = 2.750 1212
437.5 = 2.640 6768
.1094444 = 0.01287022 = II

f = 0.1097859 − 2

Rule I D = 0.111"



562 = 2.749 4123
430 = 2.633 4937
.1159186 = 0.1320186
0.1322290

562.5 = 2.749 8666
431 = 2.634 0966
.1157700 = 0.0129215553 = I

562.5 = 2.755 4997
430.5 = 2.633 9792
.1215205

f = 0.1215040 − 2

= 17.5 − 5.8 cm

280

11 - 12 Marlow

13 - 18 Roselle

19 Marlow Roselle

20 〃 〃

21 〃 〃

22 〃 〃

23 - 30 Roselle

Last measurement of the Roselle Lines.

27/9 1882

	%
St 1	= 0
St 2	= 0
St 3	= 0.
St 4	= 0
St 5	= +0,303
St 6	= +0,454
St 7	= −0,606.
St 8	= −0,757.
St 9	= −0,909
St 10a	= +0,454
St 10b	= 0
St 11	= +0,151
St 12	= 0
St 13	= 0,3
St 14	= 0
St 15	= 0
St 16	= 0
St 17	= −0,15
St 18	= −0,454
St 19	= −0,303
St 20	= −0,303
St 21	= −0,15
St 22	= −0,15
St 23a	= 0
St 23b	= +0,15
St 24a	= −0,15
St 24b	= 0
St 25	= −0,15
St 26	= −0,15
St 27	= +0,3
St 28	= +0,15

Marks north the 27/IX/82

[ITEM FOUND IN BOOK]

$\frac{0.01776035}{584.5} = y$

$\frac{10.33}{x}$ = x circumferential [illegible]

$\frac{10,33 \times 584,5}{0.01776035} = x$

1.0141003
2.766 7845
3.7808 848
÷ 0.2496149

5.5312599 = 339837 Circular inches of copper, represented by the German silver wire on the Roselle network.

[ITEM FOUND IN BOOK]

1 Feeder for 18/1 1883
Left 7 x 7 Distant 6 cents
with 8 Bulbs

$m = 7\frac{5}{16}$ in $= 68°$ F

$C = \cancel{0.0245754}$
$g = \cancel{0.3858800}$
$g = 0.3893427 - 2$ at 0°C
$g\,0°C = 20\frac{1}{2}$°C

607.3 592.5
605 – 595

$x = \cancel{0.0248275}$ at 0°C
$x = \cancel{0.0247977}$ – 20°C
$x = 0.0250246$ at 20½°C

x 0.024462 – C
6 x

$g\,\frac{140}{990} = 0.1870866 - 1$

Nuly $= 0.1538461 = 910$ lumpers
0.0250246
0.1788706
0.1538461
88

$g\,1.538461 = 1.1870866$
$g\,88 = 1.9444827$
$0.2426039 - 1$

Nuly $= 0.1748251$
$0.1748251 : 0.001105 = 100 : x$
$g\,0.1105 = 0.0433623 \ldots x = 0.1105$
$g\,0.17 = 0.2426039 - 1$
$0.8007584 - 1$ 0.1748251
0.63206 %.

Compt. of Hens: 20 cents counter: 0.6320 %

22/1 1883

Hens 1, 910 L.
6 24/4

0.2 Gb
$= 0.0007654$ at 66°F (20.5°C)
$g = 0.3018645 - 1$

473.3 = 2.6751365
526.7 = 2.7215635
0.9535532 – 1
0.3018645 – 1
0.2516887 – 1
0.1800684
0.1808844
0.3608428
2) 0.4866648 Total Hens
0.1803214

474 = 2.6757783
526 = 2.7209857
0.9542926 – 1
0.3018645 – 1
0.2524281
1.146
145
98.6
48.6

286 Distributed
910 Lumpers

22/1 1883

663 = 2.8215435
537 = 2.7299743
0.0915392
0.3997127 – 2
0.4808519 – 2
666 = 2.8235742
534 = 2.7275413
0.0959329
0.3997127 – 2
0.4852456 – 2
766

1) 0.0302588
0.0305665
0.0608253

2) 0.0341261
0.0279990
0.0621186

88 : 0.297 | 10.0034
330
0.000034
0.000003

[ITEM FOUND IN BOOK]

1200

[ITEM FOUND IN BOOK]

[ITEM FOUND IN BOOK]

Ch. Mitri Block I 90 Lamps 68 C.F.

22/1.1883

[ITEM FOUND IN BOOK]

0.886524990 = 88%
0.100741 = 10%
1.020148 = 2%
1.0374148

6 = 0.0476909 − 1
1.0476909
1.944482 − 50
0.002307 = 1.007441 = 100%

0.3022242

55 = 0.8100744
72.8

32.59
7.61
7.86
7.86
37.57

I = 504.9 x2 = 1009.8 × 10.33
3029.4
3029.4
10431.234 = 4.0183556
0.3022242 = 0.4802292 − 1
4538.0064

32.32
7.61
7.86
57.62.48

Weight = 1.0098 × 54.29 = 54.82 x2
72.861
72.861
709.648
764.468 ×3

II = 2169.6 x2 = 4339.2 × 10.33
1301.76
1301.76
44823.936 = 4.651 5400
0.3022242 − 0.4802292 − 1
5.171 1808
108.58

5009
87.3
2.91
0.302
5097.77 = 448314 cm.

III = 2320.84 x2 = 4641.6 × 10.33
13924.8
13924.8
47947.128 = 4.6807680
0.3022242 − 0.4802292 − 1
5.2004388
127
26.1

7614
6.7
7.82
0.522
7680.522 = 158649 cm

115
72
747

[ITEM FOUND IN BOOK]

0.926425
0.920949
0.005476
0.005508
0.000126

0.8865248
0.0344182
#920943 1

0.13767 29
4) 0.0344182

100:55 = 1.818
55
65
9.745

55:100 = 1.1.2
136/2.26
= 0.6
100

USE ONLY WHEN PHOTOCOPYING

[ITEM FOUND IN BOOK]

Shamokin P.A.

Length of feeders.

with 12 feeders.

feeder	Single Length.	3 feed.	
1	2907 feet	8721	84026
2.	2114 "	6342	61105
3.	1621 "	4863	46855
4.	1177 "	3531	34021
5.	1138 "	3414	32897
6	672 "	2016	19424
7.	200 "	600	5781
8.	666 "	1998	19251
9	983 "	2949	28413
10.	1430 "	4290	41354
11.	2427 "	7281	70153
12	3005 "	9015	86859
	9173		
	~~10534~~		circ. mil 6 in 202 Ohs Bare
	~~1361~~ 6		" " 217 "
	19276		

Single length of street wires — 9195 feet.
3 feed " " " = 27585 "

with 6 feeders.

feeder	Single Length.		
I	2631 feet	7893	150996 circ. m
II	1402 "	4206	80462 "
III	672 "	2016	38567 "
IV	719 "	2157	41264 "
V	1737 "	5211	99688 "
VI	3162 "	9486	181470 "

No. O. Q. G = 105534 C.m.

Menlo Park Notebook #235 [N-81-09-03]

This notebook covers the period September-October 1881. All of the entries are by Francis Jehl. The book contains notes, calculations, and drawings relating to various electrical tests. Included are tests of meters, dynamos, cable insulation, batteries, wire conductivity, and fuses. There are two labels on the front cover marked "General" and "Francis Jehl." The book contains 280 numbered pages.

Blank pages not filmed: 50-257, 262-280.

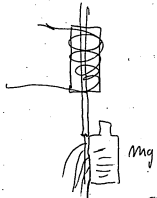
LIBRARY OF THE

BOARD OF PATENT CONTROL,

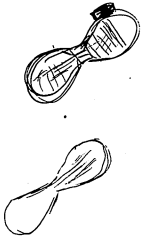
120 BROADWAY, NEW YORK.

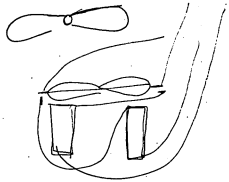
From Edison
GENERAL ELECTRIC
44 Broad St. N.Y.
May 1, 1896

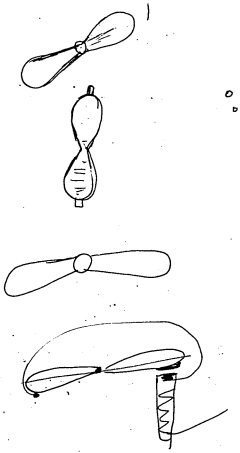
Sept 8 1881



by suction it opens orifices which lets mercury out according to the strength of the current.







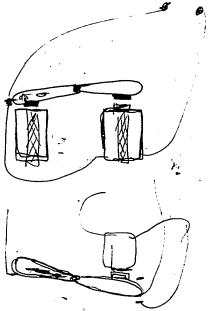
.355 ohms temp f° 84. 60 ft

No 20 60 ft . 545 ohms

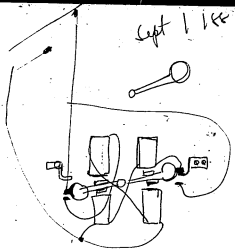
75 ½

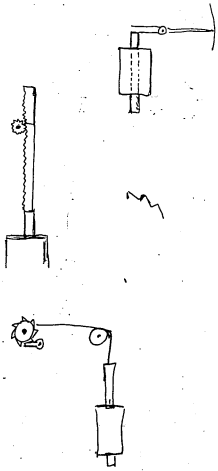
170.6) 100 (.00

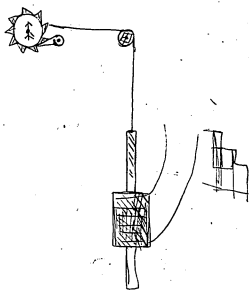
170.6) 10.000 (.00586 1 ft
10530
17700
3644
10520
10236
.35160
1.0516
10960
1.0960
3516
368

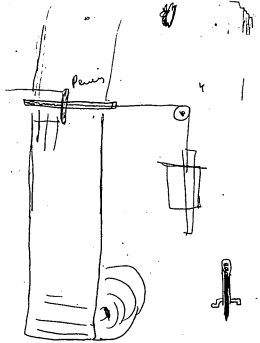


Sept 1 1881








Power

Sept. 8

Since Measured resistance of two ~~Tangent~~ Galvanometers

Large one two coils
Coil No 1 - 2.05 Ohms
Coil No 2 - 2 0 3.0 "

Small one - One coil 18.19 Ohms

Measured resistance of heavy 15 inch horseshoe electro magnet = .195 Ohms

Experiment to equalize deflection of Dynamometer Sep 8/87

20 Cells Standard Battery

Right Deflection 134
Left do — 126
Difference — 8 on R +

Taking off one coil of wire from front helix

R. Defl — 133
L Defl — 126
Dif — 7 on R +

Taking off three coils from same helix

R. Defl^n — 135
L Defl^n — 128
Dif. 7 on R +

Four coils off from same helix

R. Defl^n — 136
L Defl^n — 130
Dif — 6 on R +

over

Taking off six coils, unscrewed

R. Defl^n — 136
L Defl^n — 130
Def — 6 on R +

After altering top tension

R. Defl^n — 143
L Defl^n — 133
Def — 10 on R +

Again altering top tension

R. Defl^n — 130
L Defl^n — 130
Def. — 0

Again without further change

R. D — 130
L. D — 130
Def. 0

over

Again without further change
after a lapse of 15 minutes

R Deff'n — 133
L Deff'n — 131
Diff — 2 on R +

Sept 9th/87 Continued same Exp'm
Without atting Inst

R. Deff — 132
L Deff — 133
Diff 1 on L +

Attening Exp Version

R. Deff — 144
L Deff — 135
Diff 9 on R +

Again attening Exp Version

R. Deff 134
L Deff — 130
Diff — 4 on R +

over

Again altering tension

R Defl 125
I. Defl 127
Diff 2 on I +

Altering tension

R. D. 124
I. D 125
Diff 2 on R +

Altering tension

R.D 125
I.D 125
Diff 0

Again, 10 minutes after, without any alteration

RD 126
ID 124
Diff 2 on R +

after slightly adjusting first

R. D 123
I. D 125
Diff 2 on I +

again adjusting

R.D. 127
I.D. 124
Diff. 3 on R +

adjusting again
1 Hour after first reading

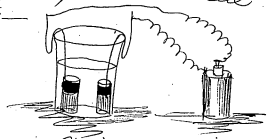
RD 122
I.D 120
Diff 2 on R +

Taking off one more coil of wire from first tube making in all seven coils unwound

RD 122
I.D 120
Diff 2 on R +

 Sep 9th / 881

Made Mercury deposition cell thus:—



put 500 Grams Mercury in each cup. Connected with 1 Cell Callard Battery 5.45 P.M.

~~This Cell~~ Used concentrated solution of Hg. Nitrate, but found that the positive cup became covered with crystals of nitrate through reduction of solution — I therefore have added about 1/4th part of water

7.45 P.M. I find that there still a small quantity of Mer. Nit being reduced on the surface of metal in positive cup so have added more water — The proportion is now about 2/3 sat. solution & 1/3 water

10 P.M. Weighed Mercury in Positive Cup & found that it had increased in weight by 4.7 Grs. (Gain) Mercury in Negative Cup weighs 489.7 Grs. showing loss of 10.3 Grs. in grains but 5.6 Grs. lost probably being oxidised and converted into nitrate —

Time of operation 4½ Hours

10.45 P.M. I repeat the foregoing experiment using as before 500 Grams Mercury in each cup, but making the solution half water & half saturated. Four cells of Callard Battery connected in multiple arc —

See P. 26

Experiments with Dynamometer

Continued from Page 21 —

Put on Dynamo current with 2400 ohm Resist. in circuit which gave as follows

R. D —— 380
I. D —— 424
Diffs 44 on R +

Adjusting zero point: —

R. D —— 395
I. D —— 365
Diff 30 on R +

R. D —— 402
I. D —— 388
Diff 14 on R. +

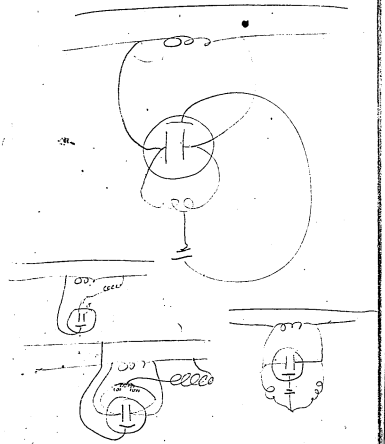
Sep 10/81 — 8.30 AM —

The result of last night's experiment shows a deposit of .9 Gr. Mercury in ~~positive~~ negative cup, the contents of which weigh 500.9 Grs. and a loss of 3.3 Grs in positive cup which weighs 496.7 Grs. — This time there have been no crystals of nitrate reduced on the surface of metal but the quantity of metal deposited appears too small —

12 Noon ~~Saturday~~ Sunday — Repeat last night's experiment under like conditions in every particular

Sep 11th Sunday — 3 P.M.

On weighing contents of cups I find that neg. Cup has gained 4.2 Grs and Positive cup has lost 6.2 Grs — Slight crystalization of ~~Pos~~ Nit. on Mercury in Pos. cup — Time of this experiment — 7 Hours —



Sept 11/81. — 3.30 PM. I repeat the expt of mercury deposition under same conditions as heretofore

Sept. 15/81.

I immersed in water a coil of insulated cable leaving ends dry.

Sept 22

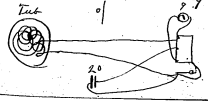
Measured above with Bridge & Thompson Galv. Measured about 11600 Ohms, Ground to gas pipe.

Sept. 27

Measured above as before with Thompson High resi. galv. 20 cells standard Battery using the Bridge. In the first case took measurements leaving key open mostly. This time kept circuit closed, measurements gave.—

2190 Ohms
3890
4800
5500
5000 after 30 minutes

Each measurement being higher than preceding



Previous two pages —

90
20

~~100~~

20 : 70 : x : 100
90 100

90) 2000 (22
22

10)60
6

The coil being connected with the galv and no battery gave a deflection too wide for the scale.

Sept. 29
1540 Ohms
1532

Removing about 4 feet at one end from the water

1750 Ohms
1730 with a loss length
1730 " " "
1740 " " "

Dividing the cable into numbered portions and measuring different lengths successively by adding to the parts in the tub each succeeding part

Div 1 = 450000 Ohms
2 parts 20500
3 " 1430
4 " 1485
5 " 1585
6 " 1643

Wire changed to gas pipe ground

4 " 1667
7 " 1690
8 " 1730
9 " 1730
10 " 1750
11 " 1540 The whole

.32456 3
20
19.47360 2
60
1168.4360 3
60
1168.4360

.015) 1168.4360 (
5

1168.4

) 1168.4

1168.4
.015
5840 3
1168
17.5520

Experiment on the Conductivity of Sulphate of Zinc at different Temperatures
Sept 18 1881

at 43°	1.8 ohms
50	1.75
53	1.63
60	1.56
65	1.40
70	1.28
76.5	1.15
82	1.07
93	93

70

Sept. 27

Took about 30 feet each wire
No 10 copper "Zinc white" cotton braided
" " "paraffine" " "

To test under water the relative insulation.

"Zinc White"

Coil put into a basin of water
one end connected to bridge and
a small coil of uninsulated
wire in the same dish for
the other terminal

65000
105000
8200 Ohms
7000
1800 = 2 hours later

"Paraffine"

After being in water nearly two
hours showed

1000000 Ohms

Sept 28 Paraffine

1100000 Ohms
180000

"Zinc white"

570 Ohms

Sept. 27-81

Measured large coil fine S. S. wire

150000 ohms

15000 "

Oct 7 1881

I short circuited the secondary battery on 1/4 ohm and obtained the deflection, on the thompson high resistance galvanometer commenced at 10.40 A.M.

10.40 = 262 = 1.777 volt

10.41 = 261

10.42 = 260 1/2

10.43 = 260

10.44 = 259

10.45 = 258 1/2

10.46 = 257

10.47 = 256

10.48 = 254

10.49 = 252

10.50 = 249

10.51 = 245

Oct 7 1881

10.52 = 243½
10.53 = 243
10.54 = 242
10.55 = 241½
10.56 = 240
10.57 = 239½
10.58 = 239
10.59 = 238
11.00 = 237
11.01 = 236
11.02 = 235
11.03 = 234
11.04 = 232
11.05 = 229
11.06 = 225
11.07 = 219
11.08 = 212
11.09 = 194
11.10 = 188

Oct 7 1881

11.11 = 185
11.12 = 184
11.13 = 182
11.14 = 180
11.15 = 178
11.16 = 176
11.17 = 173
11.18 = 170
11.19 = 166
11.20 = 160
11.21 = 153
11.22 = 147
11.23 = 140
11.24 = 137
11.25 = 132
11.26 = 125
11.27 = 107
11.28 = 101.

Oct 7th 1881

11.29 = 98
11.30 = 93
11.31 = 91
11.32 = 88
11.33 = 83
11.34 = 81
11.35 = 78
11.36 = 77
11.37 = 77
11.38 = 75
11.39 = 73
11.40 = 71
11.41 = 68
11.42 = 67
11.43 = 64
11.44 = 62
11.45 = 60

Oct 7 1881

11.46 = 59
11.47 = 58
11.48 = 57
11.49 = 56
11.50 = 55
11.51 = 54
11.52 = 52
11.53 = 51
11.54 = 50
11.55 = 50
11.56 = 50
11.57 = 49
11.58 = 48
11.59 = 48
12.00 = 47

Oct 7th 1881

1201 = 47
1202 = 47
1203 = 47
1204 = 46
1205 = 46
1206 = 46
1207 = 46
1208 = 45
1209 = 44
1210 = 44
1211 = 44
1212 = 44
1213 = 44
1214 = 44
1215 = 44
1216 = 44
1218 = 43
1220 = 42

Oct 7th 1881

1222 = 41
1224 = 41
1226 = 41
1228 = 41
1230 = 40
1232 = 39
1234 = 38
1236 = 43
1238 = 43
1240 = 41
1245 = 39
1250 = 37
1255 = 37
~~1260 =~~
100 = 39
105 = 41
110 = 38
115 = 38
120 = 37

Oct 7 1881

125 = 35
130 = 35
135 = 42
140 = 39
145 = 39
150 = 37
155 = 36
200 = 35
210 = 33
220 = 34
230 = 37
240 = 35
250 = 33
~~360~~ =
300 = 36

Oct 7 1881

One standard cell gave a deflection of 1.59

The resistance of the box used was .34 ohm.

Oct 10. 1881

Tested thermo battry made up of plates of ~~Copper~~ Carbon and plated with a copper deposit

9. plates gave a deflection of 1½ degrees on high resistance galvanometer

John F. Ott.

Oct. 19. 1881

Tested pedilom Meter and found the ball to light to work the lower magnism and the presure magnets want as many springs as light as carpalated to be put on

John F. Ott.

Oct 28. 1881

Resistence of deposit plates

1. Ohm and $\frac{1}{100}$ Temperature 19 Cent distance apart $\frac{125}{1000}$

10-25-81

Conductivity of lead wire.

Safety catches number 1, 2 & 3.

# 1 has in the plug			.046 inch	lead wire
# 2	"	"	" .040	"
# 3	"	"	" .032	"

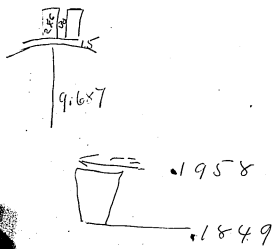
Bergman says

# 1 will carry		20	Amps
# 2	"	" 12	"
# 3	"	" 6 to 8	"

~~(Very low & probably~~

147 bars

Diameter of bobbin 9.687 inches
Height of bar .246 "
Insulation between bars .030 "
Insulation between surface of iron bobbin + bottom of Copper rods .015



diameter of iron bobbin

Height of bar .246 X 2 =	9.687
	0.492
Insulation bet iron + copper bar .015 X 2 = 0.030	
	10.209

diameter of iron bobbin with copper bars also including insulation between surface of iron bobbin and bar

10.209 inches

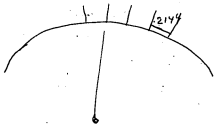
This multiply by 3.1415926 equals circumference on the outside.

10.209 X 3.1415926 =

$$\frac{32.0725188534 \text{ inches}}{142} = .2258$$

.2258
.0300
.1958 dead width of wp

```
142) 30.526855294 (.2149
     284
      412
      1142
       706
       568
        1885
        1275
```



diameter of iron bobbin

9.687

Insulation between iron & copper .0300

9.717

circumference on the top of insulation.

9.717 × 3.1415926 =

30.526855294 inches

This divided by 142 gives the length of each space at the bottom

.2149 inches

.0300

.1849 ~~and~~ width of bar at the bottom

.1849 inches

Menlo Park Notebook #236 [N-81-03-11]

This notebook covers the period March-April and December 1881. Most of the entries are by Francis Jehl. The book contains notes and calculations relating to meter experiments and to tests of dynamos and wires. Included also is a summary by Edward L. Nichols of the meter experiments. The label on the front cover is marked "Francis Jehl." The book contains 278 numbered pages. The last few pages have been torn out of the book.

Blank pages not filmed: 106-225, 228-275.

1 : 4°

240

4 : 1 :: 200 : 50

x/y 20/x

x.

4) 200 (5

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120 BROADWAY, NEW YORK.

From Library
GENERAL ELECTRIC
Lit Arc St. Mfg.
May 1, 1896

March 14 1899

Measured a German ship
its resistance was .019 ohms

910 : 30 : x : .0157
970
13090
1683

30) 18.1390 (.60
180
613
30
1800

Run of Cu plates call .6 ohms
plate 26.
.500
150
80.

gm 411.9

Current on at 10.53 am.

The solution is a saturation
of pure (C.P.) of $CuSO_4$.

Candles of lamp 16.
Stopped at 12 P.M.
started at 1.22 P.M.

2 Stopped current on
then at 4.10 Weight 412.1

26,689.3.5

Running 31.55 hr gives 9 milpowe

67
38
40
70
69/2355/3
18 2
55

Started again at 4.55
Stopped at 6.9 P.M

Current on at 9.14.5 412 grams

Set up my Motor The resistance of the shunt I used was 0.1 ohm had the reversor on all night and with eight lamps it went as follows

Shuck at
11.49 AM 1
#2 12.45 P.M 2 56 minutes
~~1040~~ 1/2 hours to 2 1 55.5 minutes
~~2~~

Commenced again at 2.58.
dropped at 4.2
Shuck at 5.8

March 11, 1881.

Summary of Meter Experiments.

— Freezing Points. —

(1) Ordinary solutions $CuSO_4 + H_2O$ freeze just under 0°C.

Addition of Glycerine lowers freezing point.

As much as 40% Glycerine can be added without interfering with the plating process. With 40% Glycerine the freezing point is below −20°C.

The Glycerine increases the resistance very materially.

Influence of strength of solution.

(2) About 20% parts $CuSO_4$ to 100 H_2O is as strong a solution as can be made at low temperatures — (see Watts Dick on Saturation points of $CuSO_4$ solutions)

The rate of the meter is within large limits independent of the strength of solution provided always that the

current remains constant

Influence of temperature upon rate of Meter.

$CuSO_4$ increases in conductivity with the temperature.
(See Niedmann, Hellners Physik Ba IV p 491)
For 18.7 parts $CuSO_4 + 100 H_2O$
Niedmann forms—

Temps.	Res.
0°C	1.60
20° "	0.738
40° "	0.523
60° "	0.384
80° "	0.330

(3) In case of metals - Matthiessen gives formula: {Poggendorff's Annalen 115 p 122.

$$C = C_0 (1 - 0.003674t + 0.0000083442t)$$

where C = Conductivity
C_0 = " at 0°
t = temp^re.

1 3

4

1.077
3.231
735
3.999
1.329
3
3.987

3.33
3.98
4.31

This gives.

Temps.	Res.
0°C	1.00
20° "	1.077
40° "	1.160
80° "	1.329

In consequence of these relations a circuit containing solutions and metals can always be so arranged that its conductivity shall be independent of the temperature.

If we use a 20% Solution of SO_4 of Copper — I find the proper ratio of metal to Solution to be 3:11

The rate of the meter at different temperatures by actual test was found to be. — (When the solution only was changed and the metal) parts of the

circuit remained at room temperature to be;

Solution 18 %.

Oscillations per hour.	Temp.
3.5	0°C
4.1	10°C
4.8	20°C
5.5	30°C
6.2	40°C

From this the compensation can be calculated; by comparison with Wiedemann's results the other errors of the instruments found.

Nichols.

Mar. 16, 1881.

METER TEST

From 2 to 1 = 12 M to 12.15 P.M
" 1 " 2 = 12.15 P.M. to 12.32 "
" 2 " 1 = 12.32 " " 12.45 "
" 1 " 2 = 12.45 " " 1 "
" 2 " 1 = 1 " " 1.15 "
" 1 " 2 = 1.15 " " 1.46 "

Not Certain

" 2 " 1 = 1.46 P.M. to 2.4½ "
" 1 " 2 = 2.4½ " " 2.27½ "
" 2 " 1 = 2.27½ " " 2.47 11/12 "
" 1 " 2 = 2.47 11/12 " " 3.12¼ "
" 2 " 1 = 3.12¼ " "

From 2 to 1 = 3.50 5/6 P.M to 4.21 11/12 P.M
(Engines stopped twice - 4")

From 1 to 2 = 4.21 11/12 P.M to 4.47¾ P.M
" 2 " 1 = 4.47¾ " " 5.13½ "
" 1 " 2 = 5.13½ " " 5.36 11/12 "
" 2 " 1 = 5.36 11/12 " "

Test on large Dynamo

March 16

magnet	deft armature	Speed	REMARKS
0	3-3	240	Permanent magnetism
14-13.5	14-13.5	244	
13.0	24.5-24	222	
30	37-37		
35	38-38		
	42-42		

magnet	armature	speed	March 16 1881

magnet armature speed)

Water experiments with March 17 1881

No 1 Weight 669.2 grams
time

Date March	Weight 669.2	
18	675.6	369"

No 2 weight 665.1 grams
time

March		
17	665.1	
18	625.1	368"

22 No 3 weight 598.9 grains

Date		
17	598.9	
18	599.	368

No 4 weight 804.6 grains 23

17	804.6	
18	804.8	367

No 5 weight 792.3 grams

Date		
17	792.3	
18	792.4	367

No 6 weight 690.

No 6		
1	690	
18	690.1	366

No 7 weight 714 grams

17	714	
18	714	366

No 8 weight 654.8

Date		
17	654.8	
18	654.8	366

Copper Plate put into a solution without Current

March 18	weight	411.8 grams
19	"	411.9
March 26		411.7
29		411.9
April 13		412.1

15) 15 | 3.4 (5

Copper Plate put in water

March 18	weight	634.7 grams
19		634.7

Copper pellets in same solution as tests are made

15 925.12 grams 2.8!
18 924.77
19 634.15 grams —

Sunday March 26 1911

260 of 65° 71 27 B

1000
260
740) 2600 (.35
2220
3800

1000
274
726) 2740 (.37
2178
5620
5082

1000
566
434 (434) 566 (1.3
434
1320
1302

566

.37
3
1.11
37
1.11 1.

.1.

3x3 = 9
3x

1x1
1+1

.23
3
.69

.10
3
1.3 .3
13) 50 (.2
26
40

Finding Mult 26 at 617 0 1.568

1432

568) Tally .76 plus

4 : 2 : 568 : 8 : 1

568) 4320 (.8
44

568) 4320 (.76
3976

3440
3408

.76
.24
304
152

1.00 2

1) .1824 (.1

.37
2
.74

.37
.76

.37
.74

4

.37
.76
1.13

.37
.76
222
259
.2812

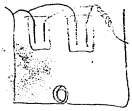
1.13) .2512 (.24
226
552
552
1000

24
72

.76

3
2
1.1812

$\frac{9}{16}$ or 14 C.M and a half peak between it, 4 m wide $3\frac{1}{2}$ long



.15
.15
.60

.015
.150

~~.997~~ 900

900 : 100 :: x : .0147

.0147
900
100) 13.230 (.160
100
323
300
23

1000
895
105

895 : 105 :: x : .0147

.0147
895
735
1323
1176
13.1565

105) 16.7365 (.15
105
623
525

both cell = .15 ohms

963
0.67

963 : 37.8 × .067

963
.067
5741
7704
963

37) 16.00.81 (.48
148
320
296

75.8 = 1

75.8) 1.000 (.013
758
2420
2274

.15
3
.45
75
.60

75.8 pitt = 1 ohms

15) 45 (3
45

45) 75.8

100) 75.8 (.758

.758

.758 ×
45
3790
3032
34.110

March 27 1881

Cow cell plate
weights 612.7 grams
612.7

Started at 11.4 AM
Stop at 6.4 P.M.

609.4 grams
610.6

610.6
609.4
1.2

other plate weights
348.7 grams
339.6 grams
340.

340
339.6
.4

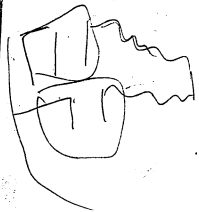


Plate No 7

855. grains
965.5 grains
855
1105

32

19.44 mg
min

.18.3 grains

.305

.005 grains lost
.0647
.0005
2300
.00002635 well
223

.2 × 3
.326

Plate No 6

688.7 grains
799.0
688.7
110.3

18.3 grains antron

110 grains in 6 hours
18.3 ant

60) 18.3 (.305
180
300
300

.326
60
19.560
60
1173600

60) .305 (.005
300
5
60
300
300

5
326 65

.005
.305

.826

$$C = \frac{\varepsilon}{R}$$

$$CR = \varepsilon$$

.005
.000 5 mi
60
hour 1 8.0 0 0 mi
10 hour 1 8 0 0 0 0

4/180
45 Tally
135 mile

1 X .01 / .01 + .6

Cell 1 = .01 / .61

1 X .6 / .01 + .6

.60 / .61

61) .326 / 305 / 21

.005 / .305

.3001 m / 60 / 18.001

Tuesday March 25 / 1881

Our

C through cell =

$1 \times \frac{.01}{.01 + .6} = \frac{.01}{.61}$

C through S =

$1 \times \frac{.6}{.01 + .6} = \frac{.60}{.61}$

$1^{mg} = \frac{.015^{gr}}{45}$ $\quad$ $\frac{135}{.015}$

$\frac{675}{60}$ $\quad$ $\frac{675}{135}$

.675 grains $\quad$ 2.025

.326 mm per 8''

.61) .326 (.005 mm per second

.61

.005

60

.300 per minute

60

18.000 per hour

10

4) 180.000 10 hours

45 min Tally cell

3

135 min

45 mg or .675 grains 10 hr

gr

2.025 or 135 mg = 10 hr

Coun. Q in

with

180 mg in 10 hr through cell and C.R.

4/180.
45 goes in tolly cell
3
and 135 lost in R

$\frac{1}{4}$/45
$11\frac{1}{4}$ mg in tolly cell

$\frac{11\frac{1}{4}}{3}$
$33\frac{3}{4}$ goes in ordinary cell

$11\frac{1}{4}$
.015
5 5
$1.13\frac{3}{4}$
$.168\frac{3}{4}$ gr

$33\frac{3}{4}$
.015
165
33
$11.\frac{1}{4}$
.406$\frac{1}{4}$

11.25 mg
168.75 gr } 10 hr

33.75 mg
406.25 gr } 10 hr

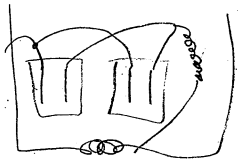
2/33.75
16.87 at 5 hr
30
506.10

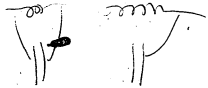
133.

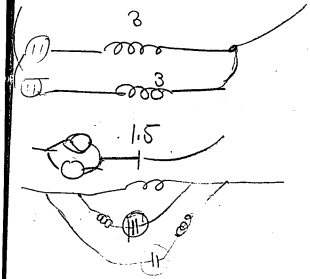
$\frac{11}{22}$.

$\frac{13}{4}$

70
30
2100.
12
4200
2100
2520






8
3
1.5

Thursday 1911

Length of German Silver strip

$18\frac{3}{8}$ long & $1\frac{1}{4}$ inches wide

Wt. of piece of .0028 gauge Cu wire in the Reduced Resistance

.0187385
830
562155 0
1499080
170) 15.5529550 (.09144
1530
252
170
829
680
1495
1360

April 7.

Test of brass resistance wire

D = .051

L = 10 ft 7½"

T = 78°.87 = 26°C

R = 830 − 170 = .207406 Ohms
.0187385

830 : 170 : X : .0187385
830
55155 0
1470800
170) 15.5259550 (.207
1400
1259
1190
.207406
690
680
1050

.0
4
6

Ans = .207406 of an alum

.051
.051
.051
.258

.002601

.002601 = D²

~~9.83~~

9.829 × 10.58
.002601

9.829
10.58
78632
49145
9829
10399042
.002601 = 39981.

7/12 | 7.0
6.0
1.00
.86
.14

.58

.002601 | 103.990820 (.718
4 04
4.258
829
9.718
9.880
21 | 9.658
9.829

.002601 | 103.990820 (39981.0
78 03 × × × ×
25 9 80
23 4 09
25 5 18
23 4 09
2 1 09 2
2 0 8 0 8
2 8 4 0
2 6 0 1
2 3 9 0

26 C

.0038240
26C
22944
7648
1.0999424

39981.
1.10

39981.
1.10
39981 0
39981
4397901 0

9.829 × 10.58 × 1.10

512
51
51
255
2601 / 9.82900 .00377
7803
20260
18207
26530
18207
2323

.00377
10.58
3016
1885
377
.0398866
1.10
3988660
398866
.04387526 0 C. 1 L.

9.829
10.58
78632
49145
9829
103.99082
1.10
10399082
10399082

51
51
51
255
2601

2601) 1143.89920 (.043979
10404
10379
7803
25469
23409
20600
18207
23982
23409
5230
.00430
.0043
10.58
2344
2150
43
.045497

1000) 4.3052 (.00430
3052
3000
52
520

2.1 (

.043979 Res of pure Copper at 75° Di = 51 length 10.58 ft

of Sample to be tested length 10.58 ft Di = 51

Res = ~~.207406~~ .09148

~~.043979 : .207406 :: x : 100~~

~~.207406) .043979 (.2~~

~~.2) .04 (.2~~

~~.04~~

.043979 C.P.C

.09148 Cupe

.09148) .043979 (.48 per cent

36592

7387.0

7318.4

3

14.2000

60) 120 (1.2

26

72

144/72

1.2

5

6.0

1.2

2.4

1.2

1.2

2.4

14.20

1.0

2

$\frac{1}{6}$ of an ohm for distribution

$\frac{1}{6}$ for return

$\frac{1}{10}$ for end

were no .028 = 75.871 per ohm

10) 75.80 (7.58 = .1 ohms

70

58

50

80

6) 75.8 (12.63 feet = 1/6 of an ohm.

6

15

38

30

20

10) 12.6 (1.26

10

26

20

6

1420 cc

14

1420 cm — 100 ohms
wire with Insulation
.010 Dia
Circumference 2.5 cm
length of Spool 2 inches

2.5 c.m
2000
5000
2
10000

10)2000

2.5
2000
5000
1500

6)60 (.1

1/6)10 (.16
6
40

1/10)16 (.1
#

1/7)15 (.14
30

1/8)10 (.2
2

1/9)11 (.11
1

100) 200 (.02
.04

100) 300 (3

300 = 2V
1 = 150

100) 2.00 (.02
2 00
.04

100) 150 (

1.5
6.0
2

100) 332 (3.32
300 2
32 6.64

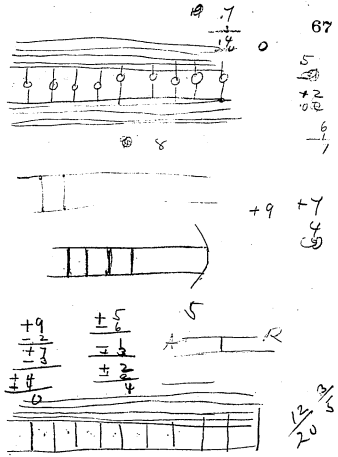
3
332.5
326.5
6.0

~~325~~

332.5 Com
326.5 Sud

334.5
325
6.0

Made 10 100 ohms Bobbins and soldered them on to the wire. 1/6 of an ohm and 1/6 return. Making a resistance of 2/6 of an ohm. Ev... by galvanized gold the fall of 2%. Then made one 100 ohms spool and total R of line 12 of and ohms and also got a fall of 2%.



13
14
15
10 16
90
150
15.50

$C = \frac{\mathcal{E}}{R}$ $\mathcal{E} = CR$ $R = \frac{\mathcal{E}}{C}$

$CR = \mathcal{E}$

$\frac{1}{5}$ $\frac{1}{12}$ $\frac{1}{60}$

$\frac{1}{5 \times 12}$ .005

45
55

April 14 1881

Large Cu 676.1 grains 695.8

Sm. Cu 462.1 grains 472.

695.8
676.1
19.7 grains

472.0
462.1
9.9

9.9

Large 702
695.8
6.2

4738
4720
1.8

Sm 473.8 477.8

Large 702. 714
702

Large 714 725½ grs

Sm 477.3 480.3

Large 725½ 480.3
477.3
3.0

Sm 480.3

Large 747.8

Sm 480.4

at 8 p 7°.

1000
263
737

263 : 737 :: K : .018738

263
56214
112428
37486

18) 62 (3.4 737 | 4.02709 4 .005
49
2638
737

K

1.8) 6.21 (3.4
5
6.0
8

1000
368
632

3) 15.6 (2.9
27
3.4
3.3
702

3.4 times

.0187 38
368
149904
102428
56214

35) 120 (3.43
105
150
140
100.2

6.7755 × 4 .010
132
4755

Large 147.8 — 147.8 − 125.7 = 22.1

Sm 486.4 − 480.3

61) 221 (3.62
183
380
366
140

Large 877.1 — 877.1 − 747.8 = 129.3 qr

Sm 521.8 − 486.4

35.4) 1293 (3.6
1062
2310
2124

ft
1145.4 to the ohm

1145.4) 100000 (.00087
91632
083680
91632
10

1 ft of no 12 wire = .000087 ohms

12) .000522 (.000435
48
42
36
60

.000435
75
2175
3045
4) .032625
.008 ohms

Shunt R

1000
372
628

372 : 628 : X : .018385

372
36770
128695
115155

~~372~~) 12838220 (.0

~~628) 12838220 (.02~~

.018385
372
374770
131169.5
562155

628) 6970 6720 (.01109 R=8
628
690
628
6267

1000
376
624

.018385
376
11243.10
131169.5
562155

757

624) 8.04567.60 (.0112 9 R.S.
624
805
624
1616
1248
5687
5596
910

.00004 47975
20
.000959500

.011291
.000959
.011332 Ro of Shunt

at 757.

2.5
3
7.5
3.5
8.75
2.5
26.25 Sq in Sur.

16
2
3.2

6.9
1.

.249
6
1.494

.249
149
2241
996
249
.37101

.249
1.49
1.739

1739) 371.01 (.21
3478
2321
1739
582

3
63
21
.84

at 75°7
Pyflange Cu Pil .249 ohms

1000
70
930 : 70 : X : .0187385

.0187385
930
562150
16875465
4
43
3

70) 17.436850 (.249
140
343
280
630
630

1000) 5.1850 (.00525
1170

Jan @			
50.25	929.5	38	939
50	932.5	36.5	938
49.75	937.		
49.50	938.5		937
49.25	941.	29	938
49	943		
48.5	946.5		
48	947.		
47.	947		
46.5	941.5		
46	945		
45	942.5		
44	942		
43	941.5		
42.5	939.5		
41	940		
40¼	939		
39¼	938.5		

Sep 27C 953
Sm 26 994 = 3

§ 2 ... Numbers after Entry

Solution Temp +20°C = +16°R = +68°F

10 ohms ohmic cell

Get the $\sqrt{4096}$

)40 96 (64
12) 4 96 (4
16

124
4 6

5 8 2 1 6

)5 8 2 1 6 9 (765
49
14) 9 2 1
7 8
152) 8 1 6 9 (5
7 6 0

)5 8 2 1 6 9 (763
49
146) 9 2 1 (
8 9 6
1523) 4 5 6 9 (
4 5 6 9

178
00
4

)9 5 6 4 8 4 (92
81
182) 1 4 6 4 (
1 3 6 4
184) 1 0 0 8 4

)9 5 6 4 8 4 (978
81
187) 1 4 6 4 (
1 3 0 9
1948) 1 5 5 8 4 (
1 5 5 8 4

57 19 89 69

)57 19 89 69 (7566
49
144) 8 1 9
7 2 8
1506) 9 9 8 9 (
9 0 3 6
15126) 9 5 3 6 9 (
9 0 7 5 6

57798969 (7563
49
145) 819
725
1506) 9459
9036
15123) 45369

√68492176 (8276
64
162) 449
324
1647) 12521
11529
16546) 992176
992176

) 101801 81 (1009
29) 0180
) 00180

) 101801 81 (1009
20) 0018081
81

2) 0180

011
200) 0180 81
180 81
2018)

√101801 81 (100
20) 01
200) 0180 81
) 101801 81 (100
20) 01
) 0180

101801 81 (1009
20) 01
2009 200) 180
9018) 180 81
180 81

)9803161 (9

9)9803161 (31 31 61

67) 80
67

623) 1931 (
1869

6261) 6261
6261

)152 27 56 (1 2 3 4

22) 52
44

243) 827
724

2464) 9856
9856

)1018081 (100

20) 01

200) 0180

2009) 18081
18081

~~when~~

When the current first enters a deposition cell, the cell has a high resistance and if the current remains constant its resistance will gradually diminish. This can be verified by actual experiment, put the deposition cell in one arm of the wheatstone bridge and get it balanced and watched. the effect, a current will gradually begin to flow and you will have to keep the bridge balanced out all the time

your resistance is constantly diminishing. This phenomenon I describe as follows.

When the current first enters a cell, its resistance is that of the fluid from plate to plate, but when the current begins to flow, and by electrolysis it takes these small particles of copper from one plate to the other it is evident that the resistance is diminished therefor its resistance being diminished a stronger current flows and this takes or deposits more

than before copper, which again decreases the resistance and so continues until it reaches its limited point, where it retains a constant resistance provided the density of the solution is always the same, and the distances between the plates is the same.

P.S. It will be noticed that when we first measure the resistance we see its resistance will diminish rapidly and gradually decrease, the decrease being lower

and slower untill it reaches its maximum point.

F. J. Le

Large Meter at 24C =

217 : 1000 - 217 :: x : 1 = 29

Small meter 24C

517 : 1000 - 517 :: x : 1 . 1.104

The above action may be made clear by supposing that there electrolytic takes place that some sulphuric acid

is set free by the deposition of copper, and that this forms a good conductor this again combines with copper & the other sides equal forms sulphate of copper. At first the action is not so rapid as when the current has been on a little while

F. J.

910 : 90 :: K : .018738
910

18738.0
168742

17061580

90) 17.061580 (.189
90
8 06
7 20
8 60
8 10

18.5°C

.018738
920

374760
168742

80) 17.24897 60 (.215
12 9
4 08

21
3
63
21
184

$$.2 \quad \frac{a \times B}{a + B}$$

1+
1.2) 2.0 (.165
12
80
72
60
60
6

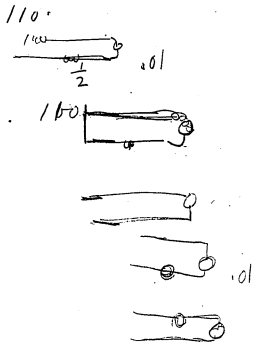
.165
3
495
165
.660

33
9
1/2

$$C = \frac{\varepsilon}{R}$$

$$CR = \varepsilon$$

$$R = \frac{\varepsilon}{C}$$



Lost on 101 of an abus chart

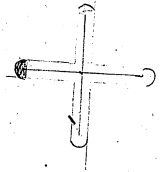
1
5

20

80

5

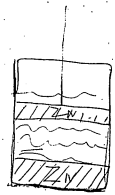
5 5 5
5 5
5 5
5 5 5

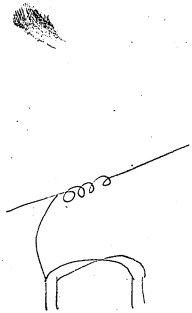


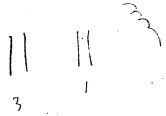
June 4 1887

Test of three pieces of Copper

~~first bar also~~






3
1

Digitized by Google

278 Lower depend no 2

Dec 25 1891

Cow	1	2.25
	2	2.31
	3	2.24
	4	2.36
Top end	1	2.28
	2	2.20
	3	2.32
	4	2.22
Bottom	1	2.03
	2	2.03
	3	2.04
	4	2.12

470) 530 (1.5
470
600

530
470) 3150 (6.7
2820
3600
3290
50

19gm = 15.43
50
77 1.50.
900

4 15 2 15
60
60 1500
9 0.00

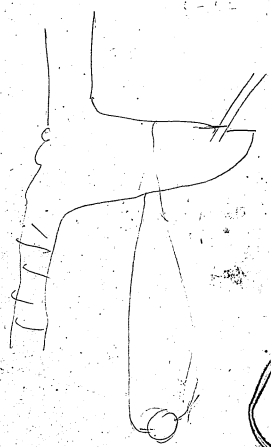
Menlo Park Notebook #238 [N-82-06-21]

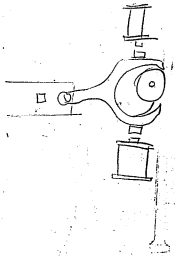
This notebook covers the periods June-August 1882 and May 1885. The entries in the first part of the book are by Edison and John Ott. Included are notes and tables relating to tests of a current regulator, tests of the conductivity of various elements in glass tubes, and tests of meters. There are also notes on filament experiments and calculations by Edison regarding costs of power plants. The entries in the second part of the book are by Edison and a laboratory assistant with the initials "M. W." There are notes by Edison on experiments to find a new form of energy, along with notes and tables of storage battery tests. The label on the front cover is marked "Cable." The book contains 280 numbered pages.

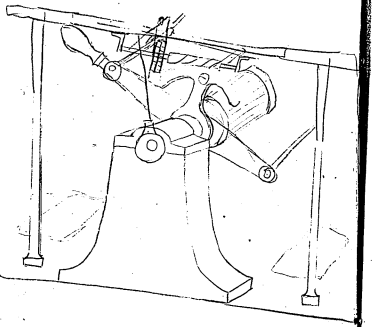
Blank pages not filmed: 82-93, 116-121, 126-132, 141, 148-149, 154-155, 276-279.

Missing page numbers: 1-40, 123-124, 133-140, 277-278.

×E-172 N-82-06-21







June 21, 1882

Tested Weber current regulator with two levers all being acted upon by one magnet, each lever short circuiting twelve ohms resistance in field circuit.

Set galvanometer so as to give a deflection of 20. $\frac{mm}{m}$ with two cells of battery, each 1.079. Volts

Battery sent lamps from 45 to 1

Deflection	Volts	Equalizer	Dif
177	92.2	89.0	4.96
177	92.2	89.0	
177	92.2	89.0	
177	92.2	89.0	
177	92.2	89.0	
169	91.1	89.0	
168	90.5	89.0	
167	90.0	89.0	
166	89.5	89.0	
165	89.0	89.0	

Table of Deflections, second Test Weber current regulator June 21. 1882. each lever cutting out the following resistance

Levers	Ohms	Def	Dif
1	8	159	
2	12	155	6
3	12	154	1
4	12	154	0
5	12	153	1
6	12	149	4
7	12	149	0
8	12	150	1
9	12	147	3
10	10	158	11

Greatest Dif 11 mm

John. F. Ott.

Volts	Dif	Plugs in	Plugs out
85.42		171	177
83.63	2.99	173	182
83.09	0.54	167	185
83.09	0.00	163	188
82.55	0.54	160	188
80.39	2.16	159	189
80.39	0.00	159	192
80.83	0.44	157	189
79.27	1.56	156	187
85.28	6.01	161	178
		172	175
			183

Greatest Dif 6.45 Volts · equals about 7.5 Candel power

June 21. 1882

Tested the same direct in line Magnet connected in Multo arc

Plugs in	Plugs out
185	181
179	186
182	190
184	193
170	196
170	194
169	192
175	192
181	181
190	179
181	185

June 23. 1882

Tested regulator with two brushes right angle to others, or nearly so. allowing a slight potentials higher on one side than the other side causing a current to flow across brushes in field circuit. I find that mutual line changes proportional to load or nearly so, But the bridge as arranged is constant and does not change potentials proportional to load as following table will show.

1	2	3	4
Def	Def	Def	Def
185	182	179	166
189	186	182	167
192	189	184	167
195	192	186	167
197	195	187	165
200	198	187	
201	199	187	
201	200	187	
199	197	182	
196	196		
185	190		
167			
This dropped to 20 lamps to nothing.	dropped to 25 lamps	dropped at 25 lamps	dropped at 65 lamps
	Changed brushes slightly		

55 after

40

12 after

5

17 after

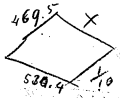
22

47.	55 Lamps
47.	55 "
50	45 "
50	45
65	35
65	35
1.05	25

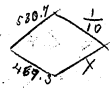
June 27, 1882.

Continuation of Experiment June 27. 1882 with Brass brushes

Resistance of leading wires Jump



0.08858696



0.08843040

0.08848358

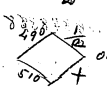
0.0945526 Brushes stopped

0.0947419

0.0949312

0.833333 Motion

0.676871



0.520408

0.094742

0.582129 Diff

very unsteady, cuts but not so much as with copper brushes

0.0981375 Brushes stopped

0.962127

0.0942879

0.120754 Motion

0.150825

0.188899

0.096213

0.056612 Diff

very unsteady

III Zinc

Motion 0.102213
Stopped 0.095618
0.006595 Diff

1983 Revol.

Not so unsteady, as I and II

IV Babbitt

Stopped 0.101902
Motion 0.096369
0.005533 Diff

1983 Revol

Resistance of brushes stoped higher

Quite steady

V Lead

Motion 0.102827
Stoped 0.097297
1983 Revol. Diff — 0.005524

VI [redacted]

Phosphorbronze.

Motion 1.017556
Stoped 0.106697
1983 Rev. Diff 0.910859

Extremely steady

Wires alone 0.09029518

VII Steel

1883 Revol Stopped 0.147651

Measurement during motion impossible
larg outside current perhaps on
account of magnetic induction

~~Steel~~

VIII Copper

Motion 0.096950
Stoped 0.093518
Diff 0.003432

1883 Revol

Eider

IX Tin

Motion 0.338075
Stoped 0.095944
Diff 0.242131

1883 Rev

First measurement during motion increasing resist,
Second resistance increases horribly

X East Iron

Motion 0.171962
Stoped 0.131750
Diff 0.040212

1883 Rev

Very unsteady

June 28. 1882 Wires alone
0.089358

XI German silver

Motion 0.108145
Stoped 0.100200
Diff 0.007945

1870 Rev

XII Nickle

Motion 0.111227
Stoped 0.098118
Diff 0.013109

1870 Rev

Very unsteady

~~Steel~~

XIII Bonanza Metal

Motion 0.479433
Stopped 0.100062
1870 Rev Diff 0.379371
Very unsteady

XIV Extra Zinc Babbitt

Stopped 0.102430
Motion first measurement 126.571450
Second 0.077936,
The observation were correct, the result is nonsense

Wire alone 0.110505
Resistance increase without doubt by heat and perhaps dust

Claudius and John F. Ott.

Amalgamated Copper brushes and Metals

I Tin and copper

Verry verry good

brushes stopped	0.0915344
Motion	0.0915527
Diff	0.0000183

II Yellow Metal

verry good

Stoped	0.0912230
Motion	0.0914429
Diff	0.0002199

III Zinc

unsteady

Stopped	0.0912961
Motion	0.0948559
Diff	0.0035598

IV Babbitt

Verry unsteady

Stopped	0.0926969
Motion	0.1065777
Diff	0.0138808

V Lead

Verry unsteady

Stopped	0.0926782
Motion	0.1513332
Diff	0.0586550

VI Phosphorbronze

Verry unsteady

Motion	0.0944491
Stopped	0.0941162
Diff	0.0036329

~~German Silver~~

VII Steel

same as I

Stopped 0.0921414
Motion 0.0920493
Diff 0.0000921 !!

The resistance becomes smaller by the motion though very steady

VIII Copper

very unsteady

Stop 0.0920308
Mot 0.0924006
Dif 0.0003698

IX Tin

very unsteady

Stop 0.0958894
Mot 0.1228907
Dif 0.0270013

~~Steel~~

XI German silver

very unsteady

Stop 0.0922157
Mot 0.0979684
Dif 0.0057527

XII Nickle

very steady

Stop 0.0924929
Mot 0.0927902
Dif 0.0002973

Bonanza Metal

very steady

Stop 0.0932507
Mot 0.0930152
Dif 0.0002345

Extra Babbitt

Only metal giving an steady current

Stop 0.0978930
Mot 0.1587649
Dif 0.0608719

~~Brass file~~

Wires alone 0.0908038

June 28. 1882

Wires alone 1st measurement
0.089358 Ohm
later 2.nd 0.110505 "
Wires perhaps dusty at the end
also warmer than before.

Charcoal Iron brushes
nothing amalgamated

I Tin and Copper

1988 rev Mot 0.109388
Stop 0.103293
very strong Diff 0.006095
outside current

II Yellow metal

Mot 0.116591
Stop 0.102041
1988 rev Diff 0.014550

III Zinc

Mot 0.163348
Stop 0.102225
very unsteady Diff 0.061153

IV Babbitt

1988 rev
unsteady

Mot 0.108848
Stop 0.103562
Diff

V Lead

Mot 0.114154
Stop 0.101410
Diff 0.012744

First measurment steady
second steady

VI Phosphorbronze

very unsteady

Mot 0.145592
Stop 0.103812
Diff 0.041780

VII Steel

Stop 0.106292

During motion a large outside current made every measurement impossible

VIII Copper

1988 rev
unsteady

Mot 0.109454
Stop 0.102635
Diff 0.006119

Wires alone 0.0090657

June 29th 1882

Wires alone 0.0885907

IX Tin

Resistance increasing surface covered with oxide 1815 rev.

Mot 0.354384
Stop 0.121362
Diff 0.233025

X Cast Iron

very unsteady
1830 rev

Mot 3.282848
Stop 2.711855
Diff 0.5710023

XI German silver

1830 rev

Mot 0.122822
Stop 0.111126
Diff 0.011696

XII Nickle

very unsteady

Mot 0.296334
Stop 0.120706
Diff 0.175628

XIII Bonanza metal

very unsteady only on account varying resistance

Mot 3.255460
Stop 0.105444
Diff 3.150016

XIV

Very unsteady

Extra Zinc Babbitt

Mt 0.506694
Stp 0.105066
Diff 0.401628

H Claudius
and
John F. Ott.

74 page 19 June 9. 1882
July 27. 1882

Tested regulator on page 40. and found it works very well,

Taken the following deflections then regulated the lights at Mr Edisons house and found them regulated [illegible].

On page 75 will be found table of Def and Volts

Deflect	Volts	Deflect	Volts
165	89.5		
164	89.	175	95.1
168	91.2	174	94.5
165	89.5	174	—
168	91.2	174	—
166	90.1	174	—
168	91.2	173	93.9
169	91.8	172	93.4
170	92.3	172	—
172	93.4	171	92.8
172	93.4	171	—
172	dido	170	92.3
173	93.9	170	—
173	—	169	91.8
173		168	91.2
		167	90.7

This is from 77 lights to 5

Difference 4.4 Volts

This is from 5 to 77

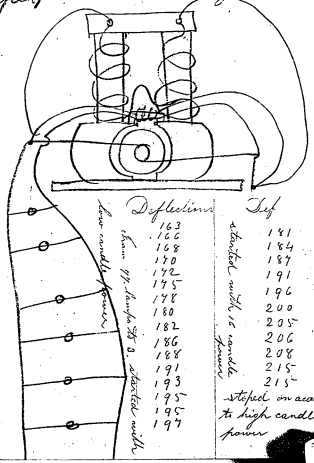
Diff 4.3 Volts

There being a slight drop in the line, that is probably bring it down to 2 Volts

July 31. 1882.

Tested and found to regulate imperfect

John. F. Ott.



Deflections	Def
.163	181
.166	184
.168	187
.170	191
.172	196
.175	200
.178	205
.180	206
.182	208
.186	215
.188	215
.191	stopped on account
.193	to high candle
.195	power
.196	
.197	

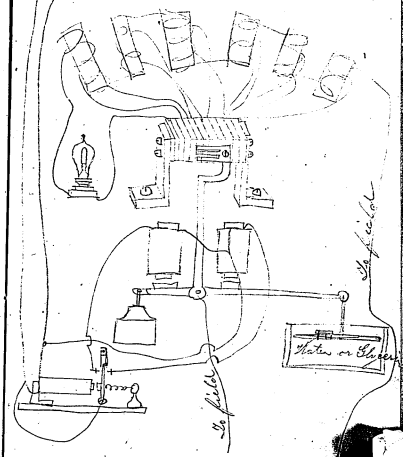
Low candle power when 17 lamps 20 ω. started with

started with 16 candle power

July 20. 1882

Main

Main



Aug 1. 1882

Tested regulator on page 79. and found it the best, that I saw. there being no sparking on Commutator

Def		Volts
174		94.5730
174		—
174		—
174		—
174		—
175		95.0525
175		
175		
175		
175		
175		—
175		—
175		—
175		—

Lamp 40 c
life 600 h
burns 3000 cf. at $2 6
profit. $3 ~~600~~
Ed

plant cost. 16 per lamp installed.
16 water
$32 at 322.
3

10 pct.

21000
2,600000

14000
16
84000
14000
224000.

14000
20
280000.
4 | 560000.
2 | 140000
4
560000

14000.

14000.

140000

20
42

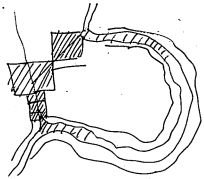
14 | 100,000 | 71.43
98
20
14
60
56
40.

15

200 | 8500 | 42
800
500
400
100

14000
71
40000
98000
994000

Cost plant

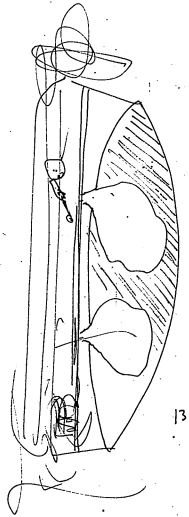


50.

85
2
170

5250
13
15750
5250
6825
50

40000 | 341,250
850 | 40000
34,000,000



100

13.

4 450.
2450.
5000
10500.

6000
8
48000.
30

39.
45

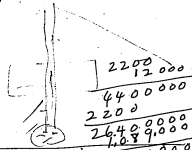
75.

20.
50.750
70
40000
1440 3850.00
6000.

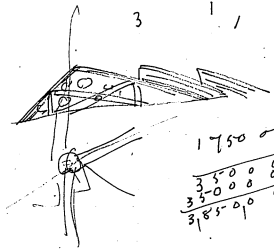
300 | 6000
20.

330000
60
19800.00
550
9900000000
990000000
10890000000

4 | 2200
5-50.
33000
.0



2200
12000000
44000000000
2200
2640000000000
1089.000000000
2.5311.000000



3 1 /

1750 000
2200
3500 00000
3500 00000
3850.00 00000

25.
8
200.

5.

5

25.

1

125.

8
200

25.

1300 / 7273 / 5.5

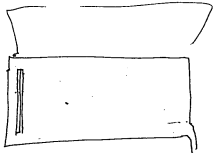
6500

7730

7500

6500

12300



Aug 22. 1882

Test for conductivity of various elements in Glass tubes 5/32 bore 4 3/4 inch long

Pure lamp Black 1210. Ohms
Common ——— 12000
Wallace Carbon burnt and powdered 31.1/3 Ohms
Wallace Com 155. Ohms
Peroxyde of Lead 16000. Ohms
Animal Black 15000. ——

John F Ott
Wm. Tice

Aug. 24. 1882.

Mixed pure lamp black and coal tar, to thick paste, then carbonized, in Plumbago Mold.

Resistance 1.3/10

Diam 95/1000

Length 3.1/8 inch

Carbonized base fibers

Resistance 4.5

Length 3. inch

Diam 80/1000

John. F. Ott,

Marlan U. Pope

Aug. 25. 1882

Tested Wheel Meter

	Time	stood at	24 Deg
Started	11.45		
	2.00	40	
	3.15	86	
	4.45	2	
	6.10	12 1/2	

This was with one cell Cooled in ice

John. F. Ott

Marlan U. Pope

Aug 26. 1882.

Mixed Dust from stove pipe with coal tar

Resistance 2.28

Length 3 inch

Diam $\frac{103}{1000}$

~~Carbonized cotton in spool shape~~

~~Resistance~~

In Cop on spool from C.T.Co

Resistance

Manilla Fiber fine

Resist

Coral

Resist

TM

Aug 29. 1882

M. N. E.

Started wheel Meter with one cell Calod battery and 50 ohms resistance out side of Meter in circuit

Time	Deflection
4.15 P M	13
6.6 " "	3½
9.30 } 2.0 A M	18
9.34 "	18

Aug 30, 1882

Restarted 1.40 with 33.3 ohms resist in circuit

Time	Deflect
1.40 P M	20
3.45 " "	21

Aug 31 1882

Record of wheat conditioned with 33.5 ohms heat in circuit.

Time	Def.	
8 AM	33	
9.45	34½ (B)	
Balls Started 6.5 Aug 31, 1882 with 20 ohms		
Time	Def.	
6.5	45	

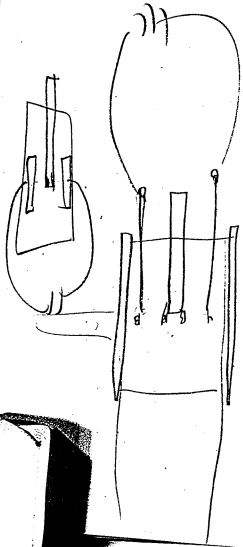
John E. Cook
W. W. J.

Aug 31. 1882

Tested regulators with 12 sounders in Mult circ 100. ohms in field each sounder short circuiting a portion of the resistance, the result was as follows

Left	Right	
155 —	84.1	When was cutting lamps out
197 —	106.9	
190 —	103.1	
195 —	105.8	
187 —	101.5	
183 —	99.3	
177 —	96.1	
176 —	95.5	
170 —	92.3	
177 —	96.1	
163 —	88.4	
160 —	86.8	
158 —	85.7	

Left	Right	
158	85.7	When was plugging lamps in
155	89.5	
167	90.7	
168	91.2	
170	92.3	
175	95.0	
180	97.7	
185	104.	
190	103.1	
195	105.8	
197	106.9	
205	111.2	
210	113.9	



J. T. Bottomley May 3 1885

Experiments to discover a new form of Energy using the Mutograph Mirror as indicator

following Electrodes to be used each pair immersed in each of the solutions

Electrodes.

Sulphur —	Zinc
"	Lead
"	Copper
Copper	Zinc
"	Carbon
"	Iron
"	Tin
Lead	Carbon
Lead	Zinc
"	Antimony
"	Bismuth
Antimony	Bismuth
Iron	Carbon
Tin	Iron
Zinc	Carbon

Mrs yB 1885

New form Energy Exports ~~Cabinet~~

J. 17.08

Liquids -

✓ Carbon Di Sulphide
✓ Turpentine
✓ Alcohol
✓ " & Chloral Hydrate
Wood Naptha
✓ Benzine
✓ Benzol
Nitro Benzol
✓ Kerosene
✓ Boiled Linseed
✓ Oil Anise
✓ Glacial Acetic acid
✓ Alcohol & Salicylic acid
Ether
Chloroform
✓ Formic acid
Hummus
Sulphurous anhydride
✓ Glycerine fumé
Sugar strong sol in alcohol
Carbolic acid
✓ Creosote
Fusel oil.

Continued p. 153

52
40 | 208
5

2080.

9400 | 4
37 | 600

9400.
15
47000
94 00
300 | 141 00 0
1200
2100
2100

470
300
141,000

300 | 9400 | 31. 470.
900
400

Information

Long Commercial Cable.

Knots 2345.
Resistance 6967
Capacity Infrared 876

Short Cable.
Insulation
33916 megohm per mile.

Short Long Island Cable

Knots 826
Resistance 13264
Capacity Microfarads 231.

On Cable 50 mf of Capacity interpolated at each end stop Earth Current through which they signal

May 3 1885 T.C.E.

Newton Energy Experiments
Continued

Lead peroxidized & Lead in Solution of Linseed oil — also Solution Sulphur in alcohol — also protoxide iron sulphate in alcohol — also same in glycerine —

Tin & hard Rubber Electrodes in Carbon Disulphide — also same Carbon substituted for tin —

Storage Batteries — Lead & Lead

Experiments continued from Vol. 50, p. 27.

Solution 4 - Manganese Sulph. & Zinc Sulph.

Battery alone on Stop	Cell alone on Cell	Time 11th May 85	Deflection
46 on left 51 " right	no deflection	2h 01' Pm.	50 on stop left
		03 "	36 " "
		05 "	20 " "
		08 "	15 " "
		11 "	16 " "
		one 5 secs	2000 Cell
		10	200 discharge
		20	150
		30	85
		40	71
		50	59
		1m	50
		10	43
		20	36
		30	32
		40	30
		50	27
		2m	24
		10	22
		20	20
		30	18
		40	17
		50	16
		3m	15
		30	14
		4m	12
		30	11
		5m	10
		30	9
		6m	8

Remarks

Repetition of a previous exp. see page 472, Vol. 50.

Solution fresh & more saturated with the manganese sulphate than the first one.

Very little gas liberated.

Deflection plate has a white coating } at 2.0 pm.
Positive " " " dark " or stain }

Stops appear to be the same as the discharge.

During second charge spongy zinc collects at lower ends of plates

10 min	37
30 secs	37
11 min	37
12	37
13 min (2nd)	37
14 min	37
15 min	36
16 (2nd)	35
17	34
18 min	33
19 min	33
20 (2nd)	32
22	32

2h 18	20 on steep
19	15 " "
21	17 " "
23	16 " "
29	14 " "
5 secs	at right angles
10	" " "
20	" " "
30	" " "
40	" " "
50	" " "
1 min	150
10	120
20	80
30	70
40	64
50	60
2 min	55
10	53
20	50
30	48
3 min	44
30	42
4 min	39
30	37
5 min	37
30	37 U
6 min	37
30	38
7 min	39
30	40
8 min	39
30	38
9 min	38
30	37

15 left 2° deck light
17 right

Was opening fine
would this time

3h 05	11 on steep
30	10 " "
06	9 " "
07	8 " "
08	8 " "
13	7 " "
18	7 " "
2 secs	off deck
10	
20	150
30	140
40	135
50	130
1 min	130
10	80
20	60
30	51
40	45
50	38
2 min	30
10	27
30	26
3 min	21
30	18
4 min	16
30	14
5 min	14
30	13
6 min	13
30	13
7 min	12
8	11
9	11

Prime solution – 4th Charge

	1° defl. left
12m	39
30"	40
13m	41
30	42
14m	43
30	44
15m (3:55)	45
30	46
16m	46
17m	47
18m	48
30	49
19m	50
20m (Lost)	50
21m	49
22m	49
23m	48
24m	48
25min	48
27m	48
28m	48
29m	48
30m	48
32min	48

8h 30'	15 left –
32	8 "
40	7 "
secs	off scale
30	150
40	145
50	140
1 min	140
10	138
20	134
30	130
40	160
50	70
2m	60
10	54
20	49
30	45
40	41
50	38
3m	37
10	35
20	34
30	33
4m	30
30	29
5m	29
30	29
6m	28
30	28
7m	29
8m	31
9m	33
10 – (3:50)	35
11	37
30	38

5th charge

	1° defl. left
12'	28
13	28
14	27
15 – (4:50)	27
17	27
18	26
20	25
21	24
22	24
24	23
25 (5:40)	27
26	31
30	33
27	36
30	39
28	41
30	42
29	42
30	42
30	42
31	42
30	40
32	41
33	42
34	42
36	42
39	42
45	39
49	37

4h 25'	12 on th.
35	11 " "
28	10 " "
29	8 "
35	7 " "
1 secs	off scale
40	150
50	145
1min	140
10	140
20	137
30	135
40	135
50	135
2m	130
10	120
30	80
40	60
50	53
3m	47
10	43
20	41
30	38
4m	32
30	31
5m	30
30	30
6m	29
30	28
7m	28
30	25
8m	28
9m	25
10m	28
11m	28

Lin + Lin — 12th May. am

Charge of plates in Solution 89.

Betting	Cell Nothing	Time	Reflection
		9h 35'	5 on strip
		36'	4½
		38	4½
		46'	4½
		10 secs	150 on coil
		20	130
		30	115
		40	115
		50	115
		1m	115
		30	115
		2m	115
		30	110
		3m	95
		10	80
		20	60
		30	50
		40	47
		50	43
		4m	40
		10	37
		20	34
		30	32
		40	30
		50	27
		5m	26
		10	24
		20	22
		30	21
		50	20
		6m	19
6m 30 sec	18		
7m	17		
30	15		
8m	14		
30	13		
9m	13		
30	12		
10	11		
30	11		
11	10		
30	10		
12	10		
30	9		
13	9		
14	9		
15	8		
16	8		
17	8		
18	8		
19	8		
20	7		
21	7		
22	6		
23	6		
24	6		
25 (10:10)	6		

Very little spongy time formed on plates.

26	6
27	6
28	5
29	5
30 (10:40)	5
32	5
34	4
36	4
37	4
38	4
40	4

Yth chase - 20 minutes.

Pot	Cell	Time	Refl.
	Nothing	12: 13	6 on Strip
		14	5 " "
		23	4
		33	4 " "
		10 secs	150 on Cap
10 mins	16	20 "	140
11 mins	15	30 "	135
12	14	40 "	130
13	14	50 "	130
14	13	1m	120
15	13	20	120
16	12	2m	120
18	11	30	120
20	10	3m	115
22	9	30	100
		L 40	80
		50	50
		4 mins	50
		10 secs	40
		20	28
		30	26
		40	24
		50	22
		5m	20
		30	16
		6m	23
		30	21
		7m	20
		30	19
		8m	18
		30	17
		9m	16
		30	16

Comparison of cells of $ZnSO_4 + MnSO_4$ with Zinc & Zinc

Solution B — 10,3 mns $ZnSO_4$ + 10,1 — $MnSO_4$ + H_2O — H_2O

Time	Defl.	Time	Deflection
2h 01' 00"	5 charge	2h 14' 00"	5 charge
02' 00"	5	15' 00"	5
03' 00"	5	16' 00"	5
04' 00"	5	18' 00"	5
05' 00"	4½	19' 00"	5
06' 00"	4½		
06 00	150 discharge	19' 50"	110 discharge
10	140	10"	75
20	37	20"	72
30	26	30"	65
40	20	40"	45
50	17	50"	35
(1) 07' 00	15	(1) 20' 00	27
10	14	10"	23
20	13	20"	20
30	12	30"	18
40	11	40"	16
50	11	50"	15
(2) 08' 00	10	(2) 21' 00	14
30	9	10	13
(3) 09' 00	8	20	13
30	7	30	12
10' 00	7	40	11
30	6	(3) 22' 00	8
(5) 11' 00	5	30	7
30	4	(4) 23' 00	6
(6) 12' 00	4	30	5
		(5) 24' 00	4
		30	4
		(6) 25' 00	3
		30	3
		(7) 26' 00	2

Discharged sufficiently before next charging.

3rd charge

2h 32' 00	5 charge
33' 00	5
42' 00	4½
42' 50	150 discharge
10"	120
20"	110
30"	95
40"	85
50"	85
(1) 43' 00"	81
10"	75
20"	60
30"	50
40"	43
50"	37
(2) 44' 00	32
10	28
20"	23
30"	20
40"	18
50"	17
(3) 45' 00	16
30	15
(4) 46'	13
(5) 47' 30	10
30	6
(6) 48'	5
30	4
(7) 49'	4
30	3
(8) 50'	3

Solution "O" - 15 grms $Zn SO_4$ + 15 grms $Mn SO_4$ + 1 ccm grm H_2O

Time	Deflection	Time	Deflection
8^h 57' 00"	5 charge	8^h 06' 00"	5 charge
58' 00"	5 "	07' 00"	5 "
59' 00"	5 "	11' 00"	5 "
59' 50"	150 discharge	11' 8"	160 discharge
00	80 "	10	140 "
20	35	20	65
30	19	30	36
40	13	40	26
50	10 "	50	18
9^h 00	8	(1) 12' 00	16
10	7	10	13
20	6	20	11
30	5	30	10
40	4	40	9
50	4	50	8
1' 00	3	(2) 13' 00	7
10	3	10	6
30	3	20	5
2' 00	3	30	4
30	2	(3) 14' 00	3
(4) 3'	2	30	3
30	2	(4) 15'	2
(5) 4'	1	30	2
		(5) 16	2

Time	Deflection
8^h 19' 00"	5 charge
20' 00	5 "
29 00	5 "
29	
30	150 discharge
20	120
30	82
40	56
50	41
(1) 30 00	33
10	27
20	22
30	19
40	17
50	16
(2) 31' 00	15
10	14
20	13
30	12
40	11
50	10
(3) 32' 00	9
10	8
(4) 33' 30	7
(5) 34' 30	5
(6) 35' 30	3
(7) 36' 30	2
36	2

Solution "D" [illegible]

3^d ... 52' -- 00 -- 5 charge
53 -- 00 -- 5 "
57 -- 00 -- 5 "

57 -- 7 -- 100 discharge
10' -- 20
20 -- 20
30 -- 52
40 -- 15
50 -- 13
58 -- 00 -- 10
10 -- 8
20 -- 7
30 -- 6
40 -- 6
50 -- 5
59 -- 00 -- 5
10 -- 5
20 -- 4
30 -- 4
4^h -- 00 -- 00 -- 4
30 -- 3
01 -- 00 -- 3
30 -- 2
02 -- 00 -- 2

4^h 00' 20 -- 5 charge
05 -- 5 "
09 -- 5 "

09 -- discharge
10 -- 150
20 -- 110
30 -- 75
40 -- 48
50 -- 32
10 -- 00 -- 23
10 -- 20
20 -- 17
30 -- 14
40 -- 13
50 -- 12
11 -- 00 -- 10
10 -- 9
20 -- 8
30 -- 7
40 -- 5
50 -- 5
12 -- 00 -- 4
10 -- 4
30 -- 3
13 -- 2
30 -- 2
14 -- 1

3^d 14 00 -- 5 charge
15' 00 -- 5 "
27 00 -- 5 "

27 -- 00 -- discharge
10 --
20 -- 150
30 -- 120
40 -- 90
50 -- 72
28 -- 00 -- 75
10 -- 60
20 -- 47
30 -- 35
40 -- 30
50 -- 27
29 -- 00 -- 24
10 -- 19
20 -- 17
30 -- 16
40 -- 15
50 -- 14
30' -- 00 -- 13
10 -- 12
20 -- 10
30 -- 9
31 -- 00 -- 8
30 -- 6
32' -- 00 -- 5
30 -- 4
33 -- 4
30 -- 3
34 -- 3

5h 01' 00 --- 5 charge
07' 00 --- 5 "
06 00 --- 11/2 "
06' 5 --- 100 discharge
10 --- 60
20 --- 25
30 --- 14 "
40 --- 10
50' --- 8
(1) 07' --- 00 --- 6 "
10 --- 5
20 --- 4
30 --- 4
40 --- 3
50 --- 3
(2) 08' --- 00 --- 3
30 --- 3
3) 09 --- 00 --- 3
30 --- 2
(4) 10 --- 00 --- 2

5h 11' --- 00 --- 5 charge
12 --- 00 --- 5 "
14 --- 00 --- 5 "
16 5 --- 100 discharge
10 --- 70
20 --- 37 "
30 --- 26
40 --- 22 "
50 --- 16
(1) 17' --- 00 --- 12
10 --- 10
20 --- 9
30 --- 9
40 --- 8
50 --- 8
(2) 18' 00 --- 8
10 --- 7
20 --- 7
30 --- 7
(3) 19' --- 00 --- 6
30 --- 6
4) 20' --- --- 5
30 --- 5
5) 21 --- --- 5

5h 22' --- 00 --- 5 charge
23 --- 00 --- 5 "
32 --- 00 --- 11/2 "
32 05 --- 100 discharge
10 --- 95
20 --- 57
30 --- 41
40 --- 39
50 --- 36
33' --- 00 --- 35
10 --- 33
20 --- 29
30 --- 25
40 --- 22
50 --- 18
(2) 34' --- 00 --- 16
10 --- 15
20 --- 14
30 14
(3) 35' --- --- 13
30 --- 12
(4) 36 --- --- 11
30 --- 11
(5) 37 --- --- 10
30 --- 10
(6) 38 --- --- 10
30 --- 9
(7) 39 --- --- 9

13th May 1880. Ann. Sin & Ji.

Time	Refl.
9h 17' 00	5½ charge
18 00	5 "
26 00	5 "
32 3 00	150 discharge
10	73
20	33
30	25
40	16
50	13
(1) 33 00	11
10	10
20	9
30	9
40	8
50	7
(2) 34 00	8
10	7
30	7
3 35 00	6
36	6
4 36	5
30	4
5 37	4

Time	Refl.
9h 38' 00	5 charge
3 in 00	4½ "
38 00	4½ "
39' 00	150 discharge
10	110
20	65
30	46
40	34
50	26
(1) 39 00	22
10	18
20	16
30	14
40	13
50	12
(2) 40 00	12
10	11
20	10
30	9
(3) 41 00	8
30	7
(4) 42 00	6
30	5
(5) 43 00	5

3rd charge

9h 49' 00	4½ ch.
50 00	4½
59 00	4½
59' 7	150 disch.
10	130
20	110
30	78
40	69
50	58
10h 00	52
10	43
20	37
30	33
40	30
50	27
(2) 01 00	25
20	22
30	20
(3) 02 00	18
30	16
(4) 03 00	14
30	12
(5) 04 00	11
30	11
(6) 05 00	10
30	10
(7) 06	9

Copper (+) & Zinc (−)

11h 22' 00"		4 charge
33	00	3/2 "
27	00	3/2 "
27		discharge
	10	120
	20	56
	30	33
	40	23
	50	18
(1) 28'	00	15
	15	13
	30	11
	45	10
(2) 29'	00	9
	15	9
	30	8
	45	8
(3) 30	00	8
	15	8
	30	7
(4) 31		7
	30	7

11h 32	00	4 charge
34	00	4 "
38	00	4 "
38	5	4 discharge
	10	120
	20	40 "
	30	28 "
	40	20
	50	15 "
(1) 39	00	14
	15	13
	30	12
	45	11 "
(2) 40	00	10
	15	9
	30	9
(3) 41	00	8
	30	8
(4) 42	00	7
	30	6
(5) 43	00	6
	30	5
(6) 44	00	5

5th charge		
11h 46'	00"	5 charge
47	00	4 "
56	00	3/2 "
56		discharge
	10	180
	20	100
	30	54
	40	45
	50	32
(1) 57'	00	25
	15	20
	30	17
	45	15
(2) 58'	00	14
	15	13
	30	12
	45	12
(3) 59'	00	11
	15	11
	30	10
	45	10
(4) 00	00	9
	15	9
	30	9
(5) 01	00	9
	30	8
(6) 02'	00	8
	30	8
(7) 03'	00	8

very little gas given

Beating on Zn, pure-black

" " Cu - white

178 #9 - "B" -

Tin (+) & Copper (-)

12h 16' 00"	4 charge	
07. 00	3½ "	
11. 00	3½ "	
11 -- 5 --	130 disch.	
10 --	80 "	
20 --	50 "	
30 --	33	
40 --	32	
50 --	27	
(1) 12 -- 00 --	23	
15 --	20	
30 --	18	
45 --	16	
(2) 13 -- 00 --	15	
15 --	14	
30 --	13	
45 --	12	
(3) 14 -- 00 --	11	
30 --	9	
14 15 -- 00 --	8	
30 --	7	
15' -- 00 --	7	

12 - 15 - 00 --	4 charge	
19 - 00 --	3½ "	
23 - 00 --	3½ "	
23. 7 --	150 discharge	
10 --	140.	
20 --	105	
30 --	86	
40 --	60	
50 --	49	
24' 00 --	40	
15 --	33	
30 --	27	
25' 45 --	22	
00 --	18.	
15 --	16	
30 --	15	
45 --	14	
(3) 26' 00 --	13	
15 --	12	
30 --	11	
(4) 27 - 00 --	10	
30 --	10	
(5) 28 - 00 --	9	
30 --	8	
(6) 29 - 00 --	8	

3rd charge

179

12h 30" 00"	3½ charge	
34 - 00 --	3½ "	
40 - 00 --	3½ "	
40 - 00 --	150 discharge	
10 --	140	
20 --	130	
30 --	110	
40 --	100	
50 --	85	
(1) 41 -- 00 --	73	
15 --	64	
30 --	51	
45 --	41	
(2) 42 -- 00 --	36	
15 --	30	
30 --	26	
45 --	25	
(3) 43 -- 00 --	21	
15 --	20	
30 --	19	
(4) 44 -- -- --	18	
30 --	17	
(5) 45 -- 00 --	16	
30 --	15	
(6) 46 -- 00 --	14	
30 --	13	
(7) 47 -- 00 --	13	
30 --	12	
(8) 48 -- 00 --	12	

Plates fresh in both cases & Same solution. No spongy zinc formed

Evidently Tin (+) and copper (-) is better than Tin (-) & copper (+) and better than Zn & "B" Tin + Tin

Zn amalgamated (−) & Zn (+)

#9 A"

1h	5-2'	00"	4	charge	2h 5'	00"	3½ charge
	5-3'	00	4	"	9	00	3½ "
3h	02'	00	4	"	15	00	3 "
	02	5	60	discharge	15'	5	186 discharge
		10	89			10	105
		20	76			20	62
		30	92			30	62
		40	19			40	65
(1.)	03	50	17			50	62
		00	15		(1.)	19' 00	55
		15	14			15	40
		30	13			30	35
		45	13			45	31
(2.)	04	00	12		(2.)	20' 00	26
		15	12			15	22
		30	11			30	20
		45	11			45	19
(3.)	05'	00	10		(3.)	21 00	18
		30	10			15	17
(4.)	06	00	10			30	16
					(4.)	22' 45	15
						00	14
						15	13
						30	12
						45	12
					(5.)	23 00	11
					(6.)	30	11
						24' 00	10
						30	10
					(7.)	25 00	10

Compare with p.173

Not so good as copper & zinc

Seems to retain its charge longer, though less rate so that deflections.

This charge (2nd) corresponds to 3rd of previous experiments.

Zn (+) & Zn amalgamated (−)

#9 A"

2h	5-1'	00"	4	charge	3h 06	00	4½ charge
	5-2	00	4	"	07	00	4½ "
3h	01	00	4	"	16	00	4½ "
	01'	5	100	discharge	16'	5	120 discharge
		10	53	"		10	95
		20	34			20	57
		30	21			30	40
		40	16			40	32
		50	14			50	27
(1.)	02	00	12		(1.)	17' 00	24
		15	11			15	21
		30	10			30	20
		45	9			45	18
(2.)	03'	00	9		(2.)	18' 00	17
		15	8			15	16
		30	8			30	16
		45	8			45	15
(3.)	04'	00	7		(3.)	19' 00	14
		30	7			15	14
(4.)	05'	00	7			30	14
						45	13
					(4.)	20 00	13
						30	13
					(5.)	21 00	12
					(6.)	22 00	12
						30	12
					(7.)	23 00	11

Not so good as previous combination

Copper & Copper.

Solution — Mercuric sulph. 10 grms, ZnSO4, 10 grms & H2O 100 grms

3h 39-00	5'	charge	
39-00	5	"	
45-00	5	"	
45-00	2	discks.	Us appreciable deflection after charging for 12 minutes
10			
20			
30			
40			
49-00			
15			
30			
45			
50-00			
15			
30			
45			
51-00			

Zinc plates

Solution — chloride of Zinc & potassium chloride of Zinc

4h 44'	5/2	charge	
45'	5	"	
54'	5	"	
54-05	11	discks	Us good
10	9		
20	7		
30	5		
40	4		
50	3		
55	2		

Solution — acetates of Mang. & Ceric — dark plates

5h 05'-00	5	charge	
06-00	5	"	
15'-00	5	"	
15-5	1	discharge	Us good
20	1		
30			
40			

Nitric Acid — Zinc

#4 — Nitro-prusside of Soda — Zinc & Lead

Time	Defl.	
9h 15' 00" -- 4 charge		Brown deposit of iron impurities, slide.
25' -- 00 -- 3½ "		
25' -- 3 -- 6 discharge		
10 -- 3		
20 -- 2		
30 -- 1		

#4 — Copper & Copper.

9h 33' -- 00 -- 2½ charge		Positive "Blackness"
43' -- 00 -- 2½ "		
43' -- 05 -- 15 discch.		
10 -- 12		
20 -- 7		
30 -- 5		
40 -- 4		

#5 — Nitro-prussiate of Soda & Phos. Ac. Sol. Zinc & Iron

9h 51' -- 00 -- 2½ charge		Very little deposit.
52 -- 20 -- 1½ "		
10h 01' -- 20 -- 1 "		
01' -- 4 -- 45 discharge		
10 -- 17		
20 -- 8 "		
30 -- 6		
40 -- 5		
50 -- 4		
02' -- -- 4		
10 -- 4		

#5 — Copper & Copper

10h 05' -- 00 -- 1° charge.		
15 -- 00 -- 2 "		Green deposit on copper
15 -- 5 -- 11		
10 -- 6		
20 -- 4		
30 -- 3		

Same as last but with more current in charging

10h 20' -- 00 -- 5° charge		Green deposit as before
30' -- 00 -- 9 "		
30 -- 5 -- 9 discharge		Less active than previous one.
10 -- 7		
20 -- 4		
30 -- 3		
40 -- 2		

Arsenious acid with copper & copper

10h 41' 00" -- 43 charge		
51' 20 -- 26 "		
58 -- 10		
10 -- 5		
20 -- 2		
30 -- 1½		
40 -- 1		

#21 - acetic acid + Phos. Ac. 5C,

Bottling	Call	Time	Refl.
54 left on 59 right stop	Not primary	Lin & Lin 11h 15 - 00 - - 15	-5 change on stop
Neptune flake gives off H.		15 - - 5 - - 10 - - 30 - - 35 - - 40 - - 50 - - 19 - 00 - - 30 - - 70 - 00 - - 71 - 00 - - 30 - - 40 - - 50 - - 22 - 00 - - 10 - -	8 discharge on coil 3 9 11 10 11 11 11 11 10 9 8 7 3 3

#33 - arsenious acid

	Not primary	Lin & Lin 11h 26 - 00 - - 36 - 00 - - 36 - 5 - - 10 - - 20 - - 30 - -	14 - change 1 2 1 1 1

#34 - Sulphide of Lime & Sulphide of Lime

7c right 6c left	2c left	12 noon - - 21 left 01 - 00 - - 18 10 - 00 - - 12 15 - 5 - - 46 10 - - 40 20 - - 50 30 - - 26 40 - - 70 50 - - 57 18 - 00 - - 46 10 - - 24 30 - - 36 (2) 17 00 - - 37 30 - - 36 (3) 18 - 00 - - 42 30 - - 43 (4) 19 - 00 - - 46 30 - - 46 (5) 20 - 00 - - 45 30 - - 44 (6) 21 - 00 - - 43 (7) 22 - 00 - - 42 (8) 23 - 00 - - 41 30 - - 40 (9) 24 - 00 - - 39 (10) 25 - 00 - - 37 (11) 27 - 00 - - 34 (12) 30 - 00 - - 40 28 40 - 00 - - 30	Spongy inner primary

"B"

Zinc(+) Copper(-)

with no half gone

12h 50-00"	5	charge
1h 00-00"	5	"
00-5	150	discharge
10	95	"
20	62	
30	43	
40	35	
50	31	
(1) 01-00	27	
15	23	
30	21	
45	20	
02-00	19	
15	18	
30	17	
45	16	
(2) 03-00	16	
30	15	
04-00	14	
30	14	
05-00	14	
06-00	14	
07-00	14	
08-00	14	
09-00	14	
10-00	14	
11-00	14	

1h 12-00	5	charge
24-00	5	"
24-4	150	discharge
12	120	
20	86	
30	70	
40	59	
50	50	
25-00	46	
15	37	
30	31	
45	26	
(1) 26-00	22	
15	20	
30	17	
45	16	
(3) 27-00	15	
15	15	
30	14	
45	14	
(4) 28-00	13	
30	13	
(5) 29-00	12	
30	11	
(6) 30-00	10	
30	10	
(7) 31-00	10	

"B"

Zinc(+) Copper(-)

1h 32-00	5	charge
44-00	5	"
44-70	150	discharge
10	120	
20	70	
30	51	
40	35	
50	28	
(1) 45-00	25	
15	23	
30	21	
45	20	
46-00	19	
15	18	
30	17	
45	16	
(3) 47-00	16	
30	15	
(4) 48-00	14	
30	14	
(5) 49-00	13	
30	12	
(6) 50-00	11	
30	11	
(7) 51-00	11	
30	11	
(8) 52-00	10	
30	10	
(9) 53-00	10	

1h 55-00	5	charge
2h 15-00	5	"
00-5	150	discharge
10	120	
20	112	
30	100	
40	70	
50	61	
(1) 06-00	52	
15	44	
30	36	
45	29	
(2) 07-00	24	
15	20	
30	19	
45	18	
(3) 08-00	17	
15	16	
30	15	
45	14	
(4) 09-00	13	
30	13	
(5) 10-00	12	
30	12	
(6) 11-00	11	
30	11	
(7) 12-00	10	

#9 "B" - 3rd charge of slots of tin(+) gauze(0) copper(-)

2h 16' -- 00 -- 5 charge
16 -- 00 -- 5 "
16' -- 00 -- 150 discharge
10 -- 126 "
20 -- 95
30 -- 90
40 -- 85
50 -- 80
(1) 27' -- 00 -- 77
15 -- 57
30 -- 43
45 -- 32
(2) 28' -- 00 -- 27
15 -- 23
30 -- 20
45 -- 18
(3) 29' -- 00 -- 17
15 -- 16
30 -- 15
45 -- 14
4 30 -- 00 -- 13
30 -- 12
5 31 -- 00 -- 11
30 -- 10
6 32 -- 00 -- 10
30 -- 9
7 33 -- 00 -- 9

#9 "B" 3rd charge of tin(+) & copper(-)

2h -- 35' -- 00 -- 5
45 -- 00 -- 5
45' -- discharge
15 -- 150
20 -- 130
30 -- 100
40 -- 95
50 -- 90
46 -- 00 -- 85
15 -- 70
30 -- 51
45 -- 43
47' -- 00 -- 38
15 -- 33
30 -- 30
45 -- 27
(3) 48 -- 00 -- 25
15 -- 23
30 -- 21
45 -- 20
(4) 49 -- 00 -- 19
30 -- 17
5 50 -- 00 -- 16
(6) 80 -- 15
(7) 51 -- 00 -- 15
30 14
(7) 52 -- 00 14

No advantage using a gauze substitute

192

3h 34-"B" – 10 grains Sulphate + 10 grains + 50 gr + 100 grains Sulph

3h 16. P.M. .. 5 charge
21 .. 20 .. 5 "

31 ..... discharge
10 .. 75 "
20 .. 37
30 .. 28
40 .. 22
50 .. 18
(1) 32 .. 00 .. 17
15 .. 15
30 .. 13
45 .. 11
(2) 33 .. 00 .. 10
15 .. 9
30 .. 8
45 .. 8
(3) 34 .. 00 .. 7
15 .. 7
30 .. 6
45 .. 6
(4) 35 .. 00 .. 5

3h 29. 00 .. 5 charge
34 .. 00 .. 5 "

34 .. 5 .. 150 discharge
10 .. 120
20 .. 77
30 .. 70
40 .. 50
50 .. 34
(1) 35 .. 00 .. 30
15 .. 22
30 .. 17
45 .. 14
(2) 36 .. 00 .. 12
15 .. 11
30 .. 10
45 .. 9
(3) 37 .. 00 .. 8
15 .. 8
30 .. 7
45 .. 6
(4) 37 .. 00 .. 6
30 .. 5
(5) 38 .. 00 .. 4

3rd charge

193

3h 43 .. 00 .. 5 charge
53 .. 00 .. 5 "

53 .. 6 .. 140 discharge
10 .. 120
20 .. 95
30 .. 78
40 .. 70
50 .. 73
(1) 54 .. 00 .. 70
15 .. 51
30 .. 31
45 .. 24
(2) 55 .. 00 .. 21
15 .. 19
30 .. 17
45 .. 16
(3) 56 .. 00 .. 15
15 .. 15
30 .. 14
45 .. 13
(4) 57 .. 00 .. 13
30 .. 12
(5) 58 .. 00 .. 11
30 .. 11
(6) 59 .. 00 .. 10
30 .. 10
(7) 00 .. 00 .. 9

Compare with 28.1.14 – 5
4 " " " 166 – 7
about equal to or a little less than the + the in gram. sulphate and magnesium "

see exp. 187
– very likely time was about 1 hour

Lecture suggests as the (a) coefficient is in gram + magnesium sulphate

Sn & Sn

194 Potencialphase of Sn & Sulphate of Manganese

4h	35' 00"	-5 chgs
	45' 00"	-5 "
	15 - 5	-6 discharge
	20	4
	10	3
	30	3
	40	3
	50	2
	60	2

Potencialph of Sn at first so much but came down during charging.

Very similar discharge as was given by Sn in MnSO4 p. 270 Vol. 50.

#95 Acetic Acid —

Sn & Sn

Battery	Cell	Time	Diff.
56 left	Not priming	5h 55' 00"	1 on chgs
62 right		05' 00"	3 " "
		05' 00"	-3 on coil
		10	-3
		20	-2
		30	-2
		40	-2
		50	-2

gas evolved from depolarizing plate.

Depolarizing plate decreased

Sn & Sn

#97 — Acetate of Ammon. & Chrom. Ac. Sl. 195

Battery	Cell	Time	Diff.
54 left on chgs	Not priming	5h 12' 00"	10 on chgs
61 right " "		30"	4 " "
		22 00	1 " "
gas given off freely		32 05	-5
Cuticular plate		10	-5
		20	-4
Stained a brown color		30	-4

15th May 1885 — Acc.

Solution #26 - Sulphuretted Amm & Lime - Lin & Lin

Setting	Acc
59 left	1° right
66 right	

Neptune pulse blackness & pieces off gas freely.

Lime ...

9h	23'.00	29 Strong Stage
	24'.00	27 " "
	28'.00	22 " "
	35'.00	coil-stick
	15	50
	25	40
	35	34
	40	28
	50	22
(1)	54'.00	20
	15	30
	30	20
	45	26
(2)	55'.00	23
	15	21
	30	19
	45	17
(3)	56'.00	15
	15	14
	30	13
	45	12
(4)	57'.00	12
	30	11
(5)	58'.00	11
	30	10
6	59'.00	10

#28 - Propylic acid

left - 48	Urine	9h	25'.00	3 Strong
right - 54	primary		40'.00	1
			50'.00	
Neptune pulse stained a little			55	3 - 2 Coil
			10	1
			20	1

#29 - Jennie acid

	Urine	10h	05'.00	4 Strong
			10	3
			15'.00	2
			15	2
			30	1
			40	1

#30 - Jennie Acid & Ac. Acid & Ac.

Gas burn blue.	ch	10h	37'.00	3 Strong
			38'.00	2
			47'.00	2
Both pulses stained a brownish yellow color.			47	30
			50	22
			55	14
			60	9
			70	7
			80	6
			47	6
			15	5
			30	5
			45	5

Sir H Sm

#31 - Glycerin & salt (nacl)

55 - left	Nothing	11h 05' - 00 -	1 sheep
66 right		15' - 00 -	1/2 "
Goes very lightly		15' - 3 -	3 sheep
from urethra pb.		10 -	2
		20 -	2
		30 -	1

#32 - Glycerine & Sucrose

3 on coil		11' - 18' - 00 -	35' on strip
		20 - 00 -	3 " "
Goes from urethra		30' - 00 -	2
1 left		37 - 0 -	15 sheep
		10 -	14
		20 -	10
		30 -	8
		40 -	7
		50 -	7
	60'	00 -	6
		15 -	6
		30 -	5
		40 -	5
		31 - 00 -	5
		15 -	4
		30 -	4
		45 -	4
		32 - 00 -	4

Sir H Sm

#33 - Glycerine & Phosph. ac. 86

54 left	Nothing	11h - 54' - 00 -	1 sheep
63 right		24' - 00 -	"
Urine copper.		44 - 0 -	10 - 0 - 6
Urine stain on		10 -	7
		20 -	6
		30 -	5
Irish potatoes		40 -	4
		50 -	3
immediately,		55 - 00 -	2
Goes from urethra - pb.			

#34 - Boric acid -

1 left		11h 54' - 00 -	17 on strip
		55' - 00 -	8 " "
		12h 05' - 00 -	6 " "
Goes freely from		05' - 05' -	21
off from urethra		10 -	17
Stole		20 -	12
With potatoes urine.		30 -	8
		40 -	5
Dickly blackened		50 -	3
	06'	00 -	2
Solution turnings green.		15 -	"
		30 -	1

Sun & Sh.

#35 – Cyclic ac. & Phosp. ac. Sh.

Nothing

Both plates fine
off gas fully.
Brownish stains.

12	15 Pure	5 sharp
	15	6 "
	25 – 40	4 "
	25 – 7	12 disch. on
	10	10 "
	20	7
	30	4
	40	2
	50	2

#36 – Tetanic acid

58 left
65 right

Nothing

12	45 Pure	10 Large not
	50	7 "
	55	0
	55 – 5	2 disch. on
	10	1
	20	1
	30	1
	40	

Gas given off
very freely from
radium plate
–

#37 – Tetanic acid & Ph. ac. Sh.

Nothing

Position of blackened
immediately.
– Gas given off freely
[illegible]

1	60 – 50	7 – sharp
	70	7 "
	80	7 "
	80 – 5	30
	10	15
	20	9
	30	7
	40	5
	50	4
	31 – 00	2

Sun & Sun

#38 – Alum

56 left
66 right

Nothing

1	50	50 Pure
	55	30 "
	60	15 "
	70	8 "
2	00	[illegible]
	02 – 3	32 disch.
		30
		21
		12
		8
		5
	03 – 30	5
	15	4

Gas given off
very rapidly.
Plates both blackened

#39 – Alum & Ph. ac.

Nothing

Plates stained
immediately.
– Gas liberated

2	[illegible]	7 sm. sharp
	20	7 "
	24 – 55	33
	10	26
	20	17
	30	13
	40	6
	50	7
35	00	6
	15	5
	30	5
	45	4
36	00	2

#43 – Alum & Thorium

50 light	Nothing	2h 29 a.m.	50 strong
54 light		30	20 "
		34	14 "
Gas bubbles freely		39	43 decided
Glass blackened		50	25
		55	14
		30	9
		40	7
		50	5
		40	3

#41 – Ammonium Chloride & Uranium Fluoride

		2h 44 a.m.	20 strong
Negative & gaseous deposit.		50	17 "
		55	6
		55	150 decided
2h 59 a.m.	50	10	150
15	48	20	135
30	46	30	120
3h 00	42	40	100
30	39	50	95
(6) 01	36	(1) 56	90
(7) 02	33	15	85
(8) 03	30	30	78
(9) 04	27	45	76
10 05	25	(2) 57	72
06	23	15	69
(11) 07	21	30	66
(12) 10	18	45	63
(13) 12	15	(3) 58	60
		15	58
		30	56
		45	53

#43 – Ammonium Chl. & Uranium

Nothing	3h 30 a.m.	49 ok.	
	35	27 "	
White cloud forms around plates.	45	18	
	45	[illegible]	
	50	15·0	
	30	9·3	
Spongy mass formed	40	7·2	
	50	6·3	
Grey deposits on plates.	46 50	5·0	
	55	4·7	
	5h	4·5	
	25	3·6	
	47 25	3·3	
	30	3·1	
	48 30	2·7	
	30	2·3	
	49 00	3·2	
	30	2·5	
		2·2	
	52 00	2·1	
	[illegible]	1·7	
	[illegible]	1·5	
	55 00	[illegible]	

#44 - Fulminal Claude -

Sex ♂

Not primary 4th 5th 00 - 23 stage.
Practice of blackmail 20 - 2
Thinks times of jes 30 - 9
when [illegible]
Hitts pt. pounds (trick) 35 - 7 13
10 - 10
20 - 7
30 - 6
40 - 6
50 - .5
60 - .5
15 - 4
30 - 3

#45 - Bernin ch. & Stanyan a.

Sex ♂

45 left 11° left on coil
49 right

Pain [illegible] 2 [illegible] 5th 00 - 23 ch.
10 - 25 "
45 00 - 22 "
53 30 - 18 "
55 55 - 110 check
10 - 95
20 - 70
30 - 62
40 - 26
50 - 12
(1) 54 - 00 - 8
15 - 6
30 - 4
45 - 2
(2) 55 - 00 - 2

Pain [illegible] 2 [illegible]
Practice blackmail

#46 - Sulphate & Dean

Sex ♂

39 left
42 right

Not primary 5th 01 - 10 ch.
35 - 9 "
11 - 2 "

Pain [illegible] 11 - 50 check
15 - 25 "
20 - 17 "
30 - 15 "
45 - 16
50 - 15
12 00 - 15
15 - 14
30 - 14
45 - 13
13 00 - 13
15 - 12
30 - 12
45 - 12
14 00 - 11
15 - 11
30 - 11
45 - 12
15 00 - 12

16th May, am.

50 - Carbonate of Potassium - Sir & Sm

Another	Cell	Time	Gal.
56 left	Not primary	2h 05' 00"	6 steady
57 right		14 00"	5 "
		15 00"	8
Little + sky		15' 00"	9 an will
immediately		10	6 drift
reflective film.		20	4
Probably Ba_2CO_3.		30	3
Gas fully from negative		40	2
		50	2
		16' 00"	1

51 - Bicarbonate of Potassium -

	Nothing	9h 33' 00"	6 steady
Gas visibly		43' 00"	0 "
each side		43 50	10 drops
		10	8
		20	5
		30	3
		40	2
		50	2
		44' 00"	1

56 - Sulphate of Potassium

	Nothing	9h 55' - 00"	21 steady
		56 - 00	20 "
Gas pair off		60h 05 - 00	7 "
lively		05 - 7	13
Cloudy ppt.		10	7
		20	5
		30	4
		40	3
		50	3
		66' - 00	2

53 - Bisulphate of Potass.

	Nothing	15h 16 - 00	29 steady
Gas pair off		17 - 00	27 "
fairly well		18 50	19 "
Nothing left.		19 - 00	12
Potassium left		[illegible]	4
Filmed each.		[illegible] - 3	18 drops
		10	15
		20	13
		30	12
		40	11
		50	11
	(1)	27 - 00	11
		15	10
		30	10
		45	10
		28 - 00	10
		15	10
		30	9
		45	9
		29 - 00	9

Sw & Sn

#54 - Bromide of Potassium.

50 left — Nothing
54 right

Clear, slightly pp
falls immediately
upon mixing.
Gas from reagents
Precipitate partially
Fe_2O_3, Cr_2O_3

10h	34' 00"	15	charge
	35' 00"	13	"
	36' 00"	5	"
	44' 00"	5	"
	46' 5"	18	decch
	10	10	
	20	5	"
	30	3	
	40	2	"
	50	2	"
55	00	2	"

#55 - Permanganate of Potassa.

2 hrs 15

very little chemical action.

10h	49' 00"	2	charge
	50 00"	1	"
	57' 00"	0	"
	59' 5"	18	decch
	10	17	
	20	7	
	30	5	
	40	4	
	50	4	
11h	00	00	4
		15	3
		30	3

Sw & Sn

#56 - Sulphocyanide of Potass.

50 left — Nothing
54 right

Pass green after
heating.

11h	03' 00"	13	charge
	04' 00"	11	"
	13' 00"	0	"
	13' 4"	12	decch
	10	7	
	20	5	"
	30	11	
	40	3	
	50	3	
14'	00	3	

#57 - Ferro-cyanide of Pot.

Nothing

very little
action after

12h	07' 00"	13	charge
	08' 00"	6	"
	12' 00"	0	"
	14' 5"	19	
	10	13	
	20	6	
	30	4	
	40	3	
	50	3	
24'		3	
	15	2	
	30	2	

Sin & Le

1/55 – Hypo-sulphite of Potass.

46 left
52 right

Nothing

11 54' am	28	charge
55 "	20	"
12 "	11	"
5 pm	4	"
4 "	0	"
44' 20		discharge
10	15	
20	11	
30	9	"
40	8	
50	7	
60	7	
15	6	
30	5	

Positive pole off & negative colored. p.

1/54 – Arsenate of Potass.

Not primary

11h 54' am	2	charge
55 "	1	"
12h "	0	"
04' 8	22	discharge
10	16	"
30	12	
50	9	"
40	6	
50	5	
01' 00	4	
15	3	
30	2	

Positive pole off.

Sin & Le

1/60 – Arsenate of Potass & Pot. Ac. Ed.

44 left
52 right

Not primary

12h 13' Pm	8	charge
14 00	1	
23 00	0	
23' 5	30	discharge
10	26	"
20	11	
30	7	
40	6	
50	5	
1h' 00	4	
15	4	
30	3	
45	3	
05' 00	2	

Positive pole off.

#9 "A" — 15th May am

For comparison Time readings with the 9 o'clock

Time	Deflections	Time	Deflections
9h 28' am	2 charge	9h 43' -- 00	4½ charge
31' -- 00	2 "	44 -- 00	2½ "
35' -- 00	2 "	45' -- 00	2 "
36' -- 50	50 discharge	-- 8	
10	42	5	64 discharge
20	34	10	57
30	32	20	47
40	31	30	39
50	28	40	29
(1) 26' -- 00	23	50	23
15	18	(1) 50' -- 00	20
30	16	15	17
45	13	30	14
(2) 27' -- 00	12	45	12
15	11	(2) 50' -- 00	11
30	10	15	10
45	10	30	10
(3) 28' 00	9	45	9
15	9	(3) 51' -- 00	9
30	8	15	8
45	8	30	8
(4) 29 00	7	45	8
15	7	4 52' -- 00	7
30	7	15	7
45	6	30	7
(5) 30' 00	6	45	7
		(5) 53' -- 00	6

9h 55' 00	3 charge
56' 00	2½ "
9h 06' 00	"
6 -- 5	70
10	54
20	47
30	36
40	29
1 05' 00	24
15	20
30	17
45	14
2 00' 00	12
15	11
30	11
45	11
3 00' 00	10
15	10
30	10
45	10
4 00' 00	9
15	9
30	9
45	9
5 00' 00	8
15	8
30	8
45	7
6 00	7

Does not compare well with the Tapper & Gine & manganese sulfate solutions.

Battery current is now is slightly weaker, due though to internal resist of cells

Cadmium + Cadmium

* 2 – Red Flash

Battery	Cell	Time	Eight
40 left side	not firing	10h 31'.00"	39 charge
34 right "		32'.00"	37 "
		33'.00"	34 "
		35'.00"	27 "
Plebs blackened		41'.00"	
		41'.45	15"
		50	16
		20	6
		30	3
		40	1
		50	0
		42'.00	2
		15"	3
		30	4
		45"	4
		50	3

* 4 – Nitro-prussian of Soda

	Nothing	10h 59'.00"	Zero [illegible]
		11h 00'.00	[illegible] "
Brown colouration		09'.00	1
negative [illegible]		10	6
		20	0
		30	0
		40	0

Nitro-prussic spirous + Pb. Ac. Sol.

	Nothing	11h 21'.00"	8"
		35'.00	1
		35"	7
		10	7
		20	6
		30	5"
		40	5"
		50	5"

* 6 –

40 left	8" right	11h 52'.00"	19
40 left		56'.00"	12
		12h 02'.00"	9
320 fresh from		02'.15	15"
negative in late,		10	8
		20	66
		30	66
		40	15
		50	12
		03'.00	13
		10"	12
		30	11
		45	11
		52'.00	10
		15"	10
		30	60

Col + Col

#6 - Manganese Chloride

39 left	Nothing	12h 19m 00s	21	charge
39 right		00 00	19	"
		39 00	18	"
		39 - 3	73	decrease
		10	42	
		20	28	
		30	20	
		40	12	
		50	10	
		30 00	9	
		15	8	
		30	7	
		45	6	
		31 00	5	
		15	3	
		30	2	

Position of Electrode
without of gives of
for accy.

*7 - Phosp. Acc.

	1° right	12h 45m 00s	2	charge
		55m 00s	0	
		55 - 6	27	
		10	19	
		20	7	
		30	6	
		40	5	
		50	4	
		56	3	

No calibration
See prism off
Eight

#9 Zinc Sulph + Magnesium Sulph.

	Nothing	1h 10m 00s	21	charge
		11 00	24	
		20 00	14	
		50 5	140	decrease
		0	135	
		20	120	
		30	55	
		40	29	
		50	15	
		55 - 00	12	
		15	8	
		30	7	
		45	6	
		22 00	5	

*10 - Phosph. Acc. Succ.

39 left	1° Right	1h 30m 00s	20	charge
39 Right		31 00	19	"
		56	16	"
		40	12	
		40 5	24	
		10	19	
		20	16	
		30	11	
		40	8	
		50	4	
		56	2	

Col + Ecl

#11 – Hydrocyanic acid of Merck, 7th acc. Sol.

1° left	1h	51'	av.	6 ok
Plates stained green.	3h	02	av.	2
		02	5	4 dis
			10	3
			20	3
			30	3
			40	3

#14 – Ferric cyanide

29 left 30 picked up	Nothing	3h	10'	av. 15 ok
			11'	av. 14
Gas given off			20	av. 11 dis
			30	5 3
				10 3
				20 3
				30 2
				40 2
				50 2

#15 – Boracic acid

	Nothing	2h	4h	00' 0 ok
Little gas given off			3h	av. 0
No calcination			3h	av. 2
				10 2
				20 2
				30 1
				40 1

Col + Ecl

#16 – Ammon carb + Glac. ac.

	Nothing	2h	20'	av. 3 ok
			52	av. 1
Plates + Gelatin		52	4	9 dis
			10	5
			20	2
			30	2
			40	1

#18 – Phosphorus [illegible]

	Nothing	3h	02'	av. 2 ok.
			12	av. 2
		12	5	10 dis
			10	3
			20	2
			30	1
			40	1
			50	

#19 – Acetic [illegible]

	Nothing	3h	20'	av. 17 ok
			21	av. 15
Gas burn			30	av. 9
No change			30	5 20 dis
				10 8
				20 4
				30 4
				40 3
				50 2
				60 2

#20 - Arctic acid, Cl reb

28 left nothing
30 inj. 05

3h	33' 00"	8 ch.
	34' 00"	7 "
	43' 00	7 "
	43' 4	24 disch.
	10	22
	20	22
	30	21
	40	21
	50	20
	44' 00	19
	15	14
	30	11
	45	10
	45' 00	8

very little change
[illegible]

Plates stained

#21 - Arctic acid, Cl. Ki. ac. E.G.

nothing

Plates blackened
as before.

3h	50' 00"	8 ch
4h	00. 00.	4
	5	1 disch
	10	16
	20	16
	30	15
	40	15
	50	15
	61' 00.	15
	5	15
	52. 00	15
	15	14
	30	13
	03' 45	12
	00	11

5' 15" - - - 10
30" - - - 8
45 - - - 7
4' 00 - - - 7

#23 - Arsenious acid, Cl reb

nothing

4h	15' 00"	2 ch
	16' 00"	1 "

Neg. take immediately
blackened.

	5	0 discharge
	10	0 "
	20	1 "
	30	1 "
	40	

#24 - Zinc [illegible]

24 left nothing
31 inj. 05

4h	15' 00"	16 ch
	17 00	14 "
	25	13 "
	30	5	16 disch
	35	14
	40	13
	45	13
	50	17
	55	13
30'	00	11
	15	8
	30	7
	45	6
30'	00	5
	15	5
	30	5
	45	5
32	00	2
	15	4
	20	2
	45	0

very little
change
[illegible]

25 – Citric acid

ch & red

32 left	nothing	4h	39' av. 4 ch
24 left			49' av. 4 "
			49 - - 0 lis.
geopinen off freely from neg. plate.			10 - 0
			20 - 0
			30 - 0
			40 - 0

26 – Sulph. of am. & Sulph. ferric

	nothing	4h	50' av. 13 ch
Hitch pp found			51 av. 14 "
		5h	av. 20 - 72
			9 - 160 lis.
			10 - 150
			20 - 45
			30 - 27
			40 - 17
			50 - 14
		(1)	01 av. 13
			15 - 11
			30 - 10
			45 - 10
		(2)	02 av. 9
			15 - 9
			30 - 9
			45 - 9
		(3)	03 - av. 9

ch & red

27 – Acetate of am. & Pic. acc. SC

19 left	nothing	5h	05' av. 11 ch
20 left			06 av. 16 "
			15 av. 1 "
geopinen off lit lightly			15 - 5 - 20 lis. ch
			10 - 27
			20 - 20
			31 - 13
			40 - 13
			50 - 12
		16'	20 - 11
			15 - 10
			30 - 10
		17'	45 - 10
			20 - 9

28 – Pyro-gallic acid.

	nothing	5h	20' av. 1° ch
			30 - av. 2 "
			30 - - - 1° lis. ch
			10 - 0
			20 - 0
			30 - 0

19th May '95. Am.

Bethy	All	Time	Defl.
#29 - Formic acid — Ob-r-ch			
42 left stop 44 right "	nothing	9h 05'.00"	3 charge
		15'.00"	2 - stop
Gas given off lightly. Forms a froth		15 - 4	5 discharge on coils
		10 - 4	
		20 - 3	
		30 - 3	
		40 - 3	
		50 - 2	
		16'.00"	2
#30 - Formic acid & Ph. ac. - Ob.			
	8' right	9h 27'.00"	8 ch.
Gas given off more freely than previous test.		28'.00"	7 -
		34'.00"	3 -
		37 - 5	1 discb
		10 - 1	
		30 - 1	
		50 - 0	
#31 - Glycerine & HaCl.			
	nothing	9h 42'.00"	1° ch
		52'.00"	1 "
		52'.00"	1 discb.
		10 - 1	
		20 - 0	
		30 - 0	

Bethy	All	Time	Defl.
#32 - Glycerine & Lactic acid			
36 left 37 right	1° left	9h 55'.00"	23 ch.
		56'.00"	20
Gas freely from respiratory pole.		10h 05'.00"	8 discb
		05 - 8	14
		10 - 12	"
		20 - 12	
		30 - 11	"
		40 - 11	
		50 - 11	
		06'.00"	11
		30 - 10	
		07'.00"	10
		30 - 9	
		45 - 8	
		08'.00"	7
#33 - Glyc. & Ph. ac. Ob.			
Gas from resp. pole.	nothing	10h 11'.00"	8 ch
		21'.00"	1 "
		21 - 7	3 discb
		10 - 3	
		20 - 2	
		30 - 2	
		40 - 2	
		50 - 1	

cd x cd

#34 – Oxalic acid

31 left --	Nothing	10h 34 40"	12 ch
31 right --		34 30"	3 "
		25" 20"	8
Position fl		34" 00"	0
stand			
neg. fl. prior off H.		34	-4 -12 disch.
			10 -10
			20 -8
			30 -6
			40 -5
			50 -4
			60 -3

#35 – Oxalic acid & th. ac.

	Nothing	10h 36 40"	-10 ch
Gas very freely		39 40"	-15
given off by neg.		40 "	7
plate		40	-4 -10 disch.
Photo blackened			10 -9
			20 -8
			30 -8
			40 -7
		49	50 -6
			60 -5

cd x cd

#36 – Tartaric acid

	Nothing	11h 03 40"	-5 ch.
Gas freely given		04 40	-7 "
neg. plate.		13 00	-6
		13 3	-2 dis
		10	-1
		20	-1
		30	1

#37 – Tartaric acid & th. ac. Pl

	Nothing	11h 19' 20"	-14 ch.
Gas as before		20 40"	-9
		29 40"	4
		29	-7 -11 disch.
			10 -9
			20 -6
			30 -4
			40 -3
			50 -3
			60 -2

#38 – Alum –

	2" right	11h 35	-13 ch
Gas given off freely		36	11 "
		45	9
		45 50	-25 disch.
			10 -20
			20 -14
			30 -10
			40 -7
			50 -6
			60 -5

39 alum & Pk. ac.

Col + Col

	1°. right	11h	54' aw"	15 ch
		12h	00 aw"	12 "
	off		09' aw"	11 "
			17' 06	24 dim
			10	3
			20	2
			30	2
			40	1

#40 - Alum & mang. Sulphate

15 left	nothing	12h	15	10 ch
49 right			19 aw	10 "
			25	9 "
			36 7	14 dissol
			10	8
			20	3
			30	2

#44 - Potassium Chlorate

	2° left	12h	31 aw	10 ch
			35 aw	6 "
	off		41	10 dissol
			10	5
			20	4
			30	3
			40	3
			50	2
			aw	2

Col + Col

#41 - Am. Chloride of Iron + Ferr. Sul.

34 left	nothing	2h	11' aw"	20 ch
36 right			12' aw"	17 "
			14' aw"	15 "
			21' aw	12 "
			21' 00	
			10	95
			20	90
			30	86
			40	77
			50	70
		(1)	22 aw	62
			15	56
			30	49
			45	45
		(2)	23 aw	43
			15	41
			30	39
			45	37
		(3)	24 aw	35
			15	33
			30	32
			45	31
		(4)	25 aw	31
			15	30
			30	29
			45	29
		(5)	26 aw	28
			30	27
		(6)	27 aw	26
			30	25
		(7)	28 aw	24
			30	24

See p. 202

(7)	29' aw"		23
	30"		22
(9)	30' aw"		21
(10)	31' aw"		20
	30"		19
(11)	32' aw"		18
	30"		18
(12)	33' aw"		17
	30"		17
(13)	34' aw"		17
	30"		16
(14)	35' aw"		16
	30"		16
(16)	36 aw		15
	37' aw"		15
(18)	38' aw"		15
	39' aw"		14
	40 aw"		14
(20)	41 aw		14
	42' aw"		13
(22)	43' aw"		13
	44' aw"		13
(24)	45' aw"		13
	46 aw"		12

#41 "B" Sum. Alt. of Sc. 10 pm. Zu 50, 4, 10 pm 4, 0 mg.

Time	Defl.	Time	Defl.
3h 03' 00"	-5 charge	3h 24' 00"	-5 charge
04 00"	4½ "	25' 00"	4½ "
13' 00"	4 "	34' 00"	4 "
13' -- 5	-66 disch	34' -- 5	-70 discharge
10	-64	10	-68
20	-62 "	20	-64
30	-60	30	-61
40	-51	40	-50
50	-42 "	50	-42
(2) 14' -- 00	-36	(1) 35' -- 00	-37
15	-31	15	-33
30	-26	30	-27
(2) 15' -- 45	-33	45	-25
60	-22	6 36' -- 00	-23
15	-21	15	-21
30	-20	30	-20
(3) 16' -- 45	-19	45	-20
60	-19	(2) 37' -- 00	-19
15	-18	15	-19
30	-18	30	-18
(4) 17' -- 00	-17	(4) 38' -- 00	-17
30	-17	30	-17
(5) 18' -- 00	-16	(5) 39' -- 00	-16
30	-16	30	-16
(6) 19' -- 00	-15	(6) 40' -- 00	-16
30	-15	30	-15
(7) 20' -- 00	-15	(7) 41' -- 00	-15
30	-14	30	-15
(8) 21' -- 00	-14	(8) 42' -- 00	-15
15	-13	30	-14
30	-12	(9) 43' -- 00	-14
45	-9	30	-13
(9) 22' -- 00	-5	45	-11
30	-2	(10) 44' -- 00	-9
		30	-7
		(11)	

#41 "B" (new solution) Lin & Lin

Time	Defl.	Time	Defl.
3h 47' -- 00"	4½ charge	4h 18' 00"	4½ charge
48 -- 00"	4½ "	19 00"	4 "
57' -- 00"	3½ "	28' -- 00"	3½ "
57' -- 5	-70 discharge	28' -- 5	-90 disch
10	-68	10	-72
20	-62	20	-66
30	-48	30	-62
40	-45	40	-66
50	-43	50	-59
(1) 58' -- 00	-41	(1) 29' -- 00	-57
15	-39	15	-52
30	-37	30	-47
45	-35	45	-46
(2) 59' -- 00	-34	(2) 30' -- 00	-38
15	-33	15	-36
30	-31	30	-34
45	-29	45	-32
(3) 60 -- 00	-28	(3) 31' -- 00	-31
15	-27	15	-30
30	-26	30	-28
(4) 01' -- 00	-24	(4) 32' -- 00	-26
30	-22	30	-25
(5) 02 -- 00	-20	(5) 33' -- 00	-23
15	-18	15	-21
30	-14	30	-20
(6) 45	-10	(6) 34' -- 00	-18
15	-0	15	-14
		30	-10
		45	-6
		(7) 35' 00	-3
		15	-1

232 #41 "B" — Copper-Copper

Time	Defl.	Time	Defl.
5h 00' 00"	4 charge	5h 19' 00"	4 charge
01 00"	3 "	20 00"	3½ "
10 00"	3	29 00"	3½ "
20 00"	100 disch.	29 00"	6
10	75	30	113 disch.
30	57 "	10	115
30	45	20	69
40	38	30	52
50	33	40	43
(1) 11h 00	31	50	39
15	29	(1) 30 00	36
30	27	15	33
45	26	30	30
(2) 12 00	25	45	28
15	24	(2) 31 00	26
30	23	15	24
45	22	30	23
(3) 13 00	21	45	22
15	21	(3) 32 00	22
30	20	15	21
(4) 14 00	19	30	21
30	18	(4) 33 00	20
(5) 15 00	18	30	19
30	17	(5) 34 00	19
(6) 16 00	17	30	18
30	17	(6) 35 00	17
(7) 17 00	16	30	17
15	15	(7) 36 00	16
30	14	15	15
(8) 18 00	13	30	14
45	11	45	13
15	9	(8) 37 00	11
30	6	15	8
45	2	45	6
		9h 38 00	4

5 #41 "B" — Iron-Iron — 20 Ley cells

233

Time	Defl.	Time	Defl.
9:15 am.	4½ charge	9h 45 00"	4½ charge
16 "	4½ "	49 00"	4½ "
25 00	4½ "	50	4
25 6	52 disturbance	55 5	40 disch
26	44	10	36
29	36	30	28
30	30	35	22
40	26	40	20
50	24	49	18
(1) 26 00	22	(1) 50 00	17
15	20	15	16
30	15	30	15
45	17	45	14
(2) 27 00	17	(2) 00 00	14
15	16	15	13
30	16	30	12
45	15	(3) 01 00	11
(3) 28 00	15	15	11
15	15	30	10
(4) 29 00	14	(4) 02 00	10
30	14	30	10
(5) 30 00	14	(5) 03 00	9
30	13	30	9
(6) 31 00	13	(6) 04 00	9
30	12	(7) 05 00	9
(7) 32 00	12	30	8
30	12	(8) 06 00	8
(8) 33 00	11	(9) 07 00	8
30	11	(10) 08 00	8
(9) 34 00	10		
35	10		
(13) 38 00	4		

234 #41 B — Silver Wilson

10h	17' 00"	4	charge	10h 55' 00"	3½ charge
	27' 00"	3½	"	11h 05' 00"	3 "
	27		Lisch.	05'	lisch
	10	1.50		10	1.50
	20	82		20	1.20
	30	60		30	80 "
	40	45		40	55
(1)	50'	40		50'	45
	00	36		(1) 06	00 43
	15	33		15	39
	30	30		30	36
(2)	59'	00	26	45	33
	15	26		(2) 07'	00 31
	30	23		15	30
	45	22		30	29
3.)	30'	00	21	45	28
	15	20		(3.) 08	00 25
	30	20		15	25
	45	19		30	24
(4)	31'	00	19	45	23
	30	18		(4) 09	00 22
(5)	31'	00	18	30	22
	30	18		(5) 10	00 21
(6)	33'	00	17	30	20
	30	17		(6) 11'	00 19
(7)	34	00	16	15	17
	15	15		20	15
	30	12		30	10
	45	9		40	7
(8)	35'	00	7	(7) 12	00 5
	30	5		00	2
9'	36	00	3		

#41 B, — Lisc & Lisc 235

12h	05 P.M.		8	charge	
	15		7½	"	
	15	7	3	lis	
	10	2			
	30	2			
	30	2			
	40				
	50				
	00				

#41 B, — Tucka & Tucka,

12h	32 00"	3	charge	1h	01 00"	3½	charge
	34 00"	3	"		11 00"	3	"
	34	8	37	destroy	11	5	42	lisch.
	10		37			10	39
	20		26			20	23
	30		15			30	19
	40		24			40	17
	50		23			50	16
1)	35'	00	23		(1)	12'	00	13
	15		22			15	13
	30		22			20	13
	45		21			25	12
2.)	36'	00	20		(2.)	13'	00	10
	30		20			30	12
(3)	37	00	19		(3)	14	00	10
	30		18		(4)	15	00	13
(4)	38	00	17			30	13
(5)	39	00	17		(5)	16	00	13
(6)	40'	00	16			30	13
(7)	41'	00	15		(6)	17	00	12
(8)	42	00	14			30	12
(9)	43	00	13		(7)	18	00	12
(10)	44'	00	12		(7)	19	00	12
					(9)	20	00	11

41 - "B" Carlton & Carlton

1h	55'	00"	-3°	charge	3h	24'	00" -8° charge
2h	05'	00"	-2°	"		34'	00" -2 "
	05'	5	-100	disch		34'	5 -150 disch
		10	-95				10 -130
		20	-85				20 -80
		30	-71	"			30 -63
		40	-35				40 -58
		50	-33				50 -38
(1)	06'	00	-18		(1)	35'	00 -26
		15	-14				15 -15
		30	-12				30 -12
(2)	07'	00	-8	"			45 -11
		15	-7		(2)	36	00 -20
		30	-6				15 -9
		45	-5				30 -7
(3)	08'	00	-4				45 -6
		15	-4	"	(3)	37	00 -5
		30	-3				15 -5
							30 -4
							45 -3

41 - "B" - Autumn & Autumn

3h	03'	00"	-8½ ch.
	13		1 "
	13	5	17
		10	14
		20	3
		30	2

41 - "B" - Lear & Leach

3h	36'	00"	-4 ch.	3h	49'	00"	-4 charge
	36'	00"	-2 "		50'	00"	-3 "
					50'	00"	-1½ "
	36	5	-100 disch		59'	6	-140 disch
		10	-95			10	-102
		20	-63			20	-90
		30	-60			30	-67
		40	-58			40	-57
(1)	37'	00	-56			50	-51
		15	-55	(1)	00	00	-45
		30	-48			15	-45
		45	-39			30	-42
(2)	38'	00	-31			45	-35
		15	-25	(2)	01	00	-32
		30	-21			15	-26
(3)	39'	00	-18			30	-22
		30	-16			45	-18
		30	-14	(3)	02	00	-11
		50	-8			10	-4
		60	0			15	-1
						20	0

Cadmium & Cadmium

#43 – Arsenate of Strychnine & Sulph

Port Tray	Cell	Time	Depth
55 left – 59 right –	nothing	4h 36' av –	25 charge
		37' av –	27 "
		38' av –	25 "
		40' av –	33 "
		46' av –	29
		46 – – 5	130 disch
		10	125
		20	115
		30	100 "
		40	62
		50	41
		(1.) 49' – 00	32
		15	23
		30	19
		45	17
		(2.) 47 – 00	16
		15	15
		30	14
		45	14
		(3.) 49' – 00	13
		(4.) 50' – 30	13
		00	12
		30	12
		(5.) 51' – 00	12
		30	12
		(6.) 52' – 00	11
		30	11
		(7.) 53' – 00	11

Gas given off freely from surf: plate

Cadmium & Cadmium

#45 – Bromin Chl. & Bromp. Chl.

	nothing	4h 59' 00' – 25 charge
		5h 00' av – 24 –
		07 – av – 17 –
		07' 45 – 20 disch
		10 – 21
		20 – 20 "
		30 – 17
		40 – 23
		50 – 20
		(1.) 08' – 00 – 17
		15 – 14
		30 – 11
		45 – 7
		(2.) 09' – 00 – 5
		15 – 7

Gas given off freely from surf: plate

#46 – Iodiphide of Iron

31 left 33 right	nothing	5h 13' av – 11 ch.
		14 av – 9 –
		23 av – 9
		23 – 3 – 3 disch.
		10 – 3
		20 – 2
		30 – 2
		40 – 1
		50 – 1

a little gas given off

Lead & Lead — Thursday 21st May 1914

240 Sulphuric acid 10 pms. H2O-1000 grms.

Time	Defl.	Time	Defl.
9h 25' 00"	3½ charge	9h 44' 00"	3½ ch.
26 00"	3	45 - 00	3
35 - 00	2½ "	54 - 00	2½ "
35' - 5'	40 disch	54	3 50 disch
10	12	10"	31
20	9	20	13
30	5	30	20
40	3	40	9
50	2	50	8
(1) 36' - 00	2	(1) 55' - 00	7
15	1½	15	6
		30	6
		45	5
		(2) 56 - 00	5
		15	4

3rd B charge

Time	Defl.
10h 29' 00"	3½ charge
29 00"	3 "
37 - 6	25 disch
10	15
20	12
30	9
40	8
(1) 28' - 50	7
00	6
15	5
30	5
45	5
(2) 29' - 00	4
15	4
30	4
45	4
(3) 30' - 00	3

41 - B (fresh solution) (Phenol) — Cadmium (-) 19 Tickle (+) — 241

Time	Defl.	Time	Defl.
10h 59' - 00"	4 charge	11h 24' 00"	5 ch.
11h 07 - 00"	5 "	34 - 00"	3½ "
07 - 5	60 disch.	34 - 04"	40
10	46	10	36 disch
20	38	20	32
30	37	30	31
40	35	40	30
50	34	50	31
(1) 08' - 00	33	(1) 35' - 00	30
15	32	15	30
30	31	30	30
45	30	45	29
(2) 09' - 00	30	(2) 36' - 00	29
15	19	30	28
30	19	(3) 37' - 00	27
45	19	30	25
(3) 10' - 00	18	(4) 38' 00	22
15	18	30	17
30	18	45	15
45	18	(5) 39 - 00	14
(4) 11' - 00	18	30	13
30	18	45	12
(5) 12' - 00	17	(6) 40 - 00	11
30	17	15	10
(6) 13' - 00	17	30	9
30	16	(7) 41' - 00	9
(7) 14' - 00	16	(8) 42" - 00	9
15	15	(9) 43 - 00	9
(8) 15' - 00	15	(10) 44 - 00	9
30	14	(11) 45 - 00	9
(9) 16' - 00	14	30	8
30	13	(12) 46 - 00	8
(10) 17' - 00	13		
30	12		
(11) 18' - 00	10		
(12) 19' - 00	8		

Cadmium (+) nickel (−)

δ° diff. left on cathode (primary)

12	33	00	−5/c	change	1h	12′	00″ −5/c ch
	38′	00″	−5			13′	00″ −5
	43′	00″	−5	"		20′	00″ −5
	43			Recharge		22	−5 −76 disch
		10	−60				10 −70
		20	−54				20 −68
		30	−45				30 −62
		40	−42				40 −60
		50	−36				50 −56
(1)	44′	00	−31		(1)	23	−00 −49
		15	−27				15 −37
		30	−23				30 −32
		45	−21				45 −27
(2)	45′	00	−19	"	(2)	24′	−00 −24
		30	−19				15 −22
(3)	46	00	−17				30 −21
		30	−17				45 −20
(4)	47′	00	−16		(3)	25′	−00 −20
		30	−16				15 −19
(5)	48′	00	−16		(4)	26′	−00 −19
		30	−16		(5)	27	−00 −18
(6)	49	00	−15	"	(6)	28	−00 −17
(7)	(50)	00	−15	"	(7)	29	−00 −16
(8)	51	00	−15		(8)	30	−00 −15
		30	−14		(9)	31	−00 −15
(9)	52	00	−14		(10)	32	00 −15
(10)	53′	00	−14		(11)	34	00 −14
		45	−13		(12)	35	−00 −13
(12)	55	00	−13		(13)	36	−00 −11
(13)	56	00	−13				15 −10
		30	−12				30 −9
(14)	57	00	−12				45 −8
(15)	58	30	−11		(15)	37	00 −6
(16)	59	00	−10		(16)	38	−00 −2
(17)	60	00	−8				

Cadmium (+) copper (−)

δ° diff. left

2h	24′	00″	−5	change	2h	4	5′ 00″ −5/c change
	32′	00″	−5			5	00″ −5
	32			72 disch		5	8 −80 disch
		10		75			10 −76
		20		64			20 −68
		30		56			30 −69
		40		48			40 −65
		50		48			50 −60
(1)	33	00		38	(1)	59	−00 −56
		15		31			15 −45
		30		28			30 −38
		45		25			45 −34
(2)	34′	00		23	12	00	−00 −30
		15		22			15 −26
		30		22			30 −23
(3)	35′	00		22			45 −22
		30		21	(3)	01	−00 −22
(4)	36	00		21			15 −21
		15		20	(4)	02	−00 −20
(5)	37	00		20			30 −19
		30		19	(5)	03′	00 −19
(6)	38	00		18	(6)	04	−00 −18
		45		15	(7)	05′	00 −17
(7)	39	00		17	(8)	06	−00 −16
(8)	40	00		16	(9)	07	−00 −15
	41	00		15	(10)	08	−00 −14
(10)	42	00		14			30 −13
(11)	43	00		12	(11)	09′	−00 −13
		30		10	(12)	10	−00 −12
		40		9			45 −10
		50		6	(13)	11	00 −9
(12)	44′	00		4			15 −7
		15		2	(14)	12	30 −6
							00 −3

4h 4m "B" = Copper & Cadmium (-)
9° left left

3h	19'	00"	-5	charge
	29	00"	-5	"
	39'	-5	140	dark
		10	-95	
		20	-60	"
		30	-47	
		40	-35	
		50	-35	
(1)	30'	00	-33	"
		15	-30	
		30	-28	"
		45	-27	
(2)	31'	00	-26	"
		15	-25	
		30	-24	
		45	-22	
(3)	32'	00	-21	
		30	-20	
(4)	33'	00	-19	
		30	-19	
(5)	34	00	-16	
		30	-15	
(6)	35	00	-14	
(7)	36	00	-12	
		15	-10	
		30	-8	
		45	-5	
(8)	37	00	-5	

3h	44m	00"	-5	charge
	54	00	-5	"
	54	-6	140	dark
		10	-90	
		20	-64	
		30	-50	
		40	-42	
		50	-35	
(1)	55	00	-35	
		15	-32	
		30	-29	
		45	-27	
(2)	56	00	-25	
		15	-27	
		30	-26	
		45	-24	
(3)	57	00	-22	
		15	-22	
		30	-21	
		45	-20	
(4)	58	00	-20	
		30	-19	
(5)	59	00	-19	
(6)	00	00	-18	
(7)	01	00	-17	
(8)	02	00	-15	
		30	-16	
(9)	03	00	-13	
(10)	04	00	-10	
(11)	05	00"	-5	

Previous one reduced to for 20 minutes

4h	44m	00"	-5	charge
5h	04	00"	-4/5	"
	04'	-7	100	dark
		10	-85	
		20	-72	
		30	-60	
		40	-50	
		50	-43	
(1)	05'	00	-39	
		15	-36	
		30	-34	
		45	-32	
(2)	06'	00	-30	
		15	-29	
		30	-27	
		45	-26	
(3)	07'	00	-25	
		30	-24	
(4)	08'	00	-22	
		15	-21	
(5)	09'	00	-20	
(6)	10	00	-19	
(7)	11	00"	-18	
(8)	12	00	-15	
(9)	13	00"	-17	
(10)	14	00"	-16	
(11)	15	00"	-15	
(12)	16	00"	-15	
(13)	17	00"	-16	
(14)	18	00"	-13	
(15)	19	00	-12	
(16)	20	00"	-10	

5h	00'	15"	-8
		30"	7
	31	00	-5

28 26 Hazy: Cu

41 - "B" - Cadmium (+) & Iron (-)

Time	Left	Time	Right
	Steadily increasing to left		
9h 25' ow	15 change	9h 5' ow	5 change
26 - ow	1/2 "	6' 53 ow	1/2 "
35 ow	1/2 "	10h 01 ow	1/2 "
35' 05	50 decrease	01 - 07	73 decrease
10	76	10	80
20	62	20	72
30	56	30	67
40	45	40	64
50	42	50	62
(1) 36 - 00	38	(1) 02 - 00	60
15	34	15	55
30	31	30	46
45	28	45	39
(2) 37' - 00	27	(2) 03 - 00	34
15	24	15	30
30	25	30	29
38 - 00	23	45	26
30	23	(3) 04 - 00	26
(4) 39 - 00	23	30	25
30	22	(4) 05 - 00	23
(5) 40 - 00	21	30	22
(6) 41 00	19	(5) 06 - 00	21
(7) 42 00	17	30	20
(8) 43 - 00	15	(6) 07	00
30	13	(7) 08 - 00	18
(9) 44 - 00	10	(8) 09 - 00	16
30	5	(9) 10 - 00	14
45	3	30	12
		(10) 11 - 00	10
		30	7
		45	5
		(11) 12 - 00	3

41 - "B" - Cadmium (-) & Iron (+)

Time	Left	Time	Right
10h 28' ow	4 1/2 change	10 - 49 ow	5 change
29 ow	4 "	50 ow	4 1/2 "
30 - 00	4 "	59 ow	4 "
30 - 6	53 decrease	59 - 23	60 decrease
10	49	10	65
20	40	20	61
30	35	30	54
40	32	40	50
50	29	50	47
(1) 34' - 00	27	(1) 00 - 00	45
15	26	15	23
30	25	30	21
45	23	45	20
35 - 00	22	(2) 01 - 00	19
30	20	15	15 "
(2) 36 - 00	18	30	15
30	17	(3) 02 - 00	17
(3) 37 - 00	17	30	15
30	16	(4) 03 - 00	15
(4) 38 - 00	16	30	14
30	15	(5) 04 - 00	14
(5) 39 00	15	30	13
(6) 40 - 00	15	(6) 05' 00	13
(7) 41 00	12	(7) 06 - 00	12
(8) 42 00	12	(8) 07' 00	12
(9) 43 00	10	(9) 08 - 00	11
(10) 44 00	6	(10) 09 - 00	11
30	2	(11) 10 - 00	10
		(12) 11 - 00	10
		(13) 12 - 00	10
		30	9
		(14) 13 - 00	8
		(15) 14 - 00	6
		30	4

41 B" (over solution) Calcium (+) & Silicon (−)

11h	30'	00"	4½ charge		11h	49'	00" 4 ch
	33	00"	4 "			50	00" 3½
	37	00"	3½ "			59	00" 3
	32'	06	72 disch			49	06 72 disch
		10	67				10 68
		20	62 "				20 63
		30	57				30 59
		40	48				40 54
		50	39				50 46
(1)	33	00	32 "		(1)	50	00 39
		15	31				15 33
		30	29				30 30
		45	26				45 27
(2)	34'	00	24		(2)	01	00 25
		15	23				30 22
		30	22		(3)	02	00 21
		45	21		(4)	03	30 20
(3)	35	00	20				00 19
		30	19				30 18
(4)	36	00	18		(5)	04	00 18
(5)	37	00	17				30 17
(6)	38	00	17		(6)	05	00 17
(7)	39	00	16		(7)	06	00 16
(8)	40	00	15		(8)	07	00 16
(9)	41	00	15		(9)	08	00 15
(10)	42	00	15		(10)	09	00 15
(11)	43	00	12		(11)	10	00 15
		30	8		(12)	11	00 14
(12)	44	00	3				30 13
							00 12
							30 10
					13 (12)		00 8
							15 7
							30 3

Primary working against

11h left – primary / 16h left

41 B" Calcium (−) & Silicon (+)

12h	30'	Pm	3½ ch		1h	59	00" 4 chg
	33	"	3 "			00	00" 3
	32	"	3 "			09	00" 3
	32	00	150 disch			59'	00
		10	150				10 150 disch
		20	150				20 150
		30	62				30 32
		40	48 "				40 48
		50	39				50 48
(1)	33	00	36		(1)	10	00 27
		15	31				15 36
		30	29				30 31
		45	27				45 28
(2)	34	00	26		(2)	11	00 26
		15	25 "				15 24
		30	24				30 23
		45	22		(3)	12	00 21
(3)	35	00	21				30 19
		30	19		(4)	13	00 17
(4)	36	00	18				30 15
(5)	37	00	16 "		(5)	14	00 14
(6)	38	00	15				30 13
(7)	39	00	15		(6)	15	00 13
(8)	40	00	16		(7)	16	00 13
(9)	41	00	14		(8)	17	00 12
(10)	42	00	13		(9)	18	00 12
(11)	43	00	13		(10)	19	00 12
(12)	44	00	13		(11)	20	00 12
(13)	45	00	13		(12)	21	00 11
(14)	46	00	12				
(15)	47	00	12				

Primary working against.

12h left – primary / 10h right

"B" — Cadem. (+) & Kin (−)

7° left (fermion)

36	14'	ow	4 ch.
	15'	ow	4
	24	ow	4 "
	24		85 disch
		10	84
		20	47 "
		30	45
		40	39
		50	35 "
(2)	25	00	33
		15	31
		30	37
		45	27
(3)	26	00	36 "
		15	25
		30	24
(3)	27	00	23
(4)	28	30	22
(5)	29	00	21
(6)	30	00	19
(7)	31	00	18
		30	17
(7)	32		14
		30	9
		45	6
0	33	00	3

5/90
18

36	49'	ow	4 1/2 ch
	50	ow	4 1/2 "
	59	ow	4 "
	59		95 disch
		10	78 "
		20	72
		30	66
		40	59
		50	45
(1)	50	00	43
		15	38
		30	33
		45	30
(2)	01	00	28 "
		15	27
		30	26
(3)	02	00	26
		30	25
(4)	03	00	24
(5)	04	ow	23
(6)	05	ow	21
(7)	06	00	20
		30	15
		45	16
(7)	07	ow	13
		15	9
(9)	07	30	3
		45	0

24th May. 1885. Cairo

Ammonium Chloride 10 grms } Cadmium (+)
Cadmium Chloride 10 " } Zinc (−)
Water - - - 100 "

Time	Deflection	Time	Defl.
	12° left primary = 80° charge.		
10h 25′ 20″	92 on circuit	10h 41′ 20″	92 on circuit
27′ 20″	92 "	51′ 20″	"
35′ 20″	92 (= 4% on this)	51′	4 13 disch. 10
35′	5 12 discharge		10 10 circ.
10	9		20 7 5
20	5		30 4
30	4		40 4
40	3		50 3
50	3	52′	20 3
36′	20 2		15 3
15	2		
45	2		
37′	20 1		
38′	20 1		
39′	20 0		

The cadmium sulphate gradually precipitated. At first was colourless.

#41 B

~~14~~° left primary = for 20° charge
13 reading = 20×4 = 80°

11h 34′ 20″ — 31° defl.
44′ 20″ — 29 "

44 ~~20~~
10 — 3 disch
20 — 2
30 — 2
40 — 1
50 —

#41 B Cd (+) & Zn (−) for 40° charge

11h 55′ 20″	47° defl.	12h 13′ 20″	49° defl.
12h 05′ 20″	47° "	14′ 20″	47 "
		23′ 20″	47
05′	10 80 disch	25′	5 80 disch
20	62	10	74
30	56	20	68
40	50	30	64
50	42	40	58
		50	45
(1) 06′	20 38	(1) 26′	20 43
15	34	15	36
30	30	(2) 25′	20 29
45	27	30	25
(2) 07′	20 24	(3) 26	20 17
(3) 08′	20 20	30	15
(4) 09′	20 18	(4) 27	20 14
(5) 10′	20 16	15	11
		30	8
	13	45	5
30	9	60	1
45	6		
60	2		

#50 – Carbonate of Potash. Cal & Cl.

Bottling	Cal	Time	Expl.
38 left. 11 right	Nothing	9h 10' 00" – 5 on strip	
		20' 00" – 6 " "	
		29' 00" – 10 " "	
		39 – 10 on cal	
		15 – 5	
		25 – 2 disch.	
		30 – 2	
		35 – 1	

#51 – Bicarbonate of Potash. Cal & Cl.

Bottling	Cal	Time	Expl.
11½ right		9h 35' 00" 14 on strip	
		37' 00" – 5 " "	
very little res. given off.		47' 00" – 3 " "	
		47 – 7 disch	
		10 – 4 "	
		20 – 2	
		30 – 1 "	
		40 –	

#52 – Sulphite of Potassium. Cal & Cl.

Bottling	Cal	Time	Expl.
Nothing		9h 56' 00" – 21 on strip	
Gas given off freely from very pale		57' 00" – 17 " "	
		10h 06' 00" – 15 " "	
Gelatinous coating formed on fracture plate.		06 – 6 – 12 disch	
		10 – 7	
		20 – 3	
		30 – 2	
		40 – 1	

Cal & Cl.

#53 – Bi-sulphite of Potash. 255

Bottling	Cal	Time	Expl.
Nothing		10h 17' 00" – 26 charge	
		18 00" – 23 "	
very little gas given off.		27 00" – 20 "	
		37 – 5 – 31 disch	
		10 – 13	
very pale. Thickness slightly.		20 – 9 "	
		30 – 7	
		40 – 5	
		50 – 4 "	
		20 – 00" – 4	
		15 – 3	

#54 – Bromide of Potash.

Bottling	Cal	Time	Expl.
32 left 31 right	Nothing	10h 31 00" – 15 charge	
		31 00" – 13 "	
Gas very freely given off (–)		40 00" – 12 "	
		40 – 3 – 30 disch	
		10 – 25	
		20 – 20 "	
		30 – "	
		40 – 6	
Heavy white precip.		41' 00" – 5	
Tube formed around bottom of fracture.		00" – 1	
		15 – 4	
		30 – 2	
Chokeade.		42 – 00" – 3	

Colored

#55 – Permanganate of Potass.

25 left	Nothing	10h 45' 00"	-5 obs.
30 right		55' 00"	-6 "
		55'	-3 .21 desch
		00'	-7
		20'	-2
		30'	-0
		40'	

#56 – Sulphocyanide of Potass

	Nothing	11h 03' 00"	-12 ch
		08 00"	-11 "
		13 00"	
		13'	-4 .9 desch
		10'	-3
		20'	-2
		30'	-1
		40'	

#57 – Ferro-cyanide of Potass.

	Nothing	11h 20' 00"	-5 ch.
very little		30 00"	
plus given off.		30	-4 .20
		10'	-9 desch
		20'	-8
		30'	-1
		40'	

Colored

#58 – Hypo-sulph. of Potass

	1° left	11h 35'	-21° left.
		30'	-19 "
		25'	-15 "
		45'	-7 .30 desch.
		10'	-22
		20'	-10
		30'	-6
		40'	-4
		50'	-3
		00'	-2

#59 – Arsenate of Potass

	1° left	11h 50 00"	-4° ch.
		12 00 00"	-11 "
See from back of plate		04'	-7 .16 desch
		10'	-9
		20'	-6
		30'	-4
		40'	-3
		50'	-2

Calotypes
Precipitate on
Cooling ground
arsenic position
plate.

Cadmium

#60 – [illegible] of Rubens & Kurlbaum's [illegible]

30 left – nothing.
32 right

1h 17' Rec.	-9' [illegible]
27 "	0 "
27 – "	45 circuit
10	12
20	6
30	4
40	3
50	2

a little gas from both plates.

Cadmium & Sodium.

#41 "B"

Time	Reflections on circle		Time	Reflections on circle	
12h 58' 00"	-40°	change	1h 13' Rec.	-40°	change
57 00	-40°	"	20 "	-40°	"
1h 06 00	-40°	"	21' --- 6	-70	circuit.
06 - 8	-71	discharge	10	-67	
10	-65		20	-57	
20	-53		30	-52	
30	-45	"	40	-44	
40	-41		50	-38	
50	-33		(1) 2' --- 20	-35	"
59' -- 00	-31	"	15	-32	
15	-28		30	-30	
30	-25		45	-28	
45	-22		(2) 3' 00	-26	"
2h 00	-19	"	15	-24	
15	-15		30	-22	
30	-9		(3) 3' 45	-18	
45	-2		15	-12	
50	-0	"	30	-5	
			40	-0	

#41 "B" (same sol. as before) Cd & Cd

1h	53'	mv"	80	charge	3h	11'	mv" 60 charge
3h	03	mv"	60	"		31	mv" 60 "
	03		86	disch.		31	86 disch.
			70				70
			60				60
			48				63
			44				54
			40				46
			30				29
(1)	04'		30	37	(1)	32	30 35
			15	33			15 32
			30	30			30 30 "
			45	27			45 28
(2)	05'		30	25	(2)	33	30 27
			15	23 "			15 26
			30	23			30 25
			45	22			45 24
(3)	06		30	21	(3)	34	30 24
			30	19			15 23
(4)	07'		30	18	(4)	35	30 23
			30	17			30 22
(5)	08'		45	15	(5)	36	30 21
			30	13			30 20
			10	10	(6)	37	30 17
			15	8			30 16
			30	5			30 12
			45	2			45 7
					(7)	38	30 6
							30 1

#41 "B" (same solution) Cd & Cd

3h	57'	mv"	80	charge	3h	09'	mv" 70 charge
4h	01	mv"	70			19	mv" 70 "
	01		76	disch.		19	84 discharge
			70				74
			63				70
			56				61 "
			51				52
			44				44
			38				40
(1)	02		30	38	(1)	20	30 35
			15	34			15 32 "
			30	32			30 29
(2)	03'		30	30	(2)	21	30 26
			15	26			15 25
			30	24			30 24
(3)	04		30	22	(3)	22	30 23
			30	21			15 23
(4)	05		30	21	(4)	23	30 22
			30	20			30 21
(5)	05'		30	19	(5)	24	30 20
			15	17			30 19
			30	15	(6)	25	30 18
(6)	07		45	13			15 17
			30	10			30 15
			15	6			45 13
			30	3	(7)	26	30 10
							15 7
							30 5
							45 3

41 — 15 (same solut.) — d 9 red

4h	07'	ow	— ow charge
	17'	ow	— ow "
	17'	— 6	73 disch.
		10 —	74
		20 —	67 "
		30 —	62
		40 —	50
		50 —	46
(1.)	18	— 00 —	42
		10 —	38
		20 —	34
		45 —	32
(2.)	19	— 00 —	30
		10 —	28
		20 —	26
(3)	20	45 —	25
		30 —	24
(4)	21	— 00 —	24
		30 —	24
(5)	22	— 00 —	23
		30 —	23
(6)	23	00 —	23
		30 —	22
(7)	24	— 00 —	22
		30 —	20
(8)	25	00 —	19
		30 —	18
(9)	26	00 —	17
		30 —	15
(10)	27	00 —	13
		15 —	10
		30 —	7
		45 —	5
(11)	28	00 —	3

4h	31'	ow	— ow charge
	41'	ow	— ow "
	41	— 6	20 disch
		10 —	24
		20 —	26
		30 —	30
		40 —	40
		50 —	51
(1)	42	00 —	44
		15 —	39
		30 —	34
		45 —	30
(2)	43	00 —	28
		15 —	27
(3)		30 —	26
(4)	44	00 —	25
		30 —	25
(5)	45	00 —	24
		30 —	24
(5)	46	00 —	23
(6)	47	00 —	23
(7)	48	00 —	22
(8)	49	00 —	21
(9)	50	00 —	20
		30 —	19
(10)	51	00 —	15
		30 —	15
(11)	52	45 —	13
		00 —	11
		15 —	9
		30 —	7
		45 —	6
12	53	00 —	4

41 — 15 (same solut.) — d 9 red

4h	59'	ow	— ow charge
5h	09'	ow	— 20
	09	— 7	disch
	10	— 6	
	20	— 5	"
	30	— 5	
	40	— 4	
	50	— 3	
6	15	— 00	3

Sunday, January 25th Day

4h	37'	ow	— 20 charge
	37	— 9	disch.
	10	— 9	
	20	— 9	"
	30	— 4	
	40	— 4	
	50	— 3	
	00	— 3	

26th May Contd. — carried

Star "B" (Sun & ☾)

9h	44' 00"	-80 charge
	54' 00"	-80 "
	54'	-7" -80 disch.
		10 -78
		20 -73
		30 -67
		40 -63
		50 -58
(1)	55' -- 00	-49 "
		15 -44
		30 -38
(2)	56' -- 00	-35
		30 -30
(3)	57' -- 00	-27
		30 -25
(4)	58' 00	-23 "
(5)	59' 30	-21
		-18
		30 -15
(6)	60' -- 00	-11
		30 -5
		30 -5
		45 -2 "

10h	10 00"	-85 ch.
	20 00	-80 "
	20	-3 -80 disch.
		10 -25
		20 -51
		30 -76
		40 -65
		50 -65
(1)	21' -- 00	-62
		15 -59
		30 -52
		45 -45
(2)	22' -- 00	-38
		15 -35
		30 -33
(3)	23 00	-29
		30 -26
(4)	24 00	-24
		30 -23
(5)	25 00	-22
		30 -20
	26' 00	-17
		30 -14
		45 -12
(7)	27'	-10
		15 -8
		30 -6
		45 -4
(8)	28' -- 00	-3

Star "B" (Sun)

10h	35' 00"	-100 ch.
11h	35' 00"	-100 "
	35'	-5 -80 disch.
		10 -62
		20 -58
		30 -54
(1)	36' -- 00	-54 "
		15 -50
		30 -46
		45 -43
(2)	37 -- 00	-42
		15 -41
(3)	38 -- 00	-39
		30 -35
(4)	39 -- 00	-34
		30 -33
(5)	40 -- 00	-32
(6)	41 -- 00	-30
(7)	42 -- 00	-27
(8)	43' -- 00	-25
(9)	44 -- 00	-21
		30 -16
		45 -13
(10)	45' -- 00	-10
		30 -7
		00 -5

11h	39' 00"	-100 charge
	49 00"	"
	49	-- discharge
		10 --
		20 --
		30 --
		40 --
		50 --
(1)	50' -- 00	--
		15 --
		30 --
		45 --
(2)	51' -- 00	--

G. M. T. when taken.

Lin & Lin

"B" (newsolution)

12h	12' PM	100 charge
	35' 00"	94 "
	32' 00"	91 discha
	10	72
	20	63 "
	30	58
	40	54
	50	51
(1.)	38' 00	49
	15	46
	30	44
	45	43
(2.)	24' 00	42
	15	40
	30	38
	45	35
(3.)	25' 00	33
4	35' 30	29
	00	35
	30	32
5.	27' 00	20
	30	19
(6.)	21' 00	19
	30	18
(7.)	29' 00"	17
(8.)	30' 00"	15
(9.)	31' 00"	13
(10.)	32' 00"	10
	30	7"
(11)	33' 00"	6"
	15"	3

12h	45' 00"	100 charge
	57' 00"	100
	58' 00"	50 "
	55'	51 disch decid
	10	55
	20	54
	30	52
	40	56
	50	57
(1.)	55' 00	56
	15	54
	30	52
	45	48
(2.)	57' 00	43
	15	39
(3.)	30	36
	00	32
(4.)	59' 30	29
	00	26
(4.)	30	24
	00	22
	30	20
(5.)	01' 00	19
(7.)	02' 00	17
(8)	03' 00"	15
(9)	04' 00	13
	30	10
(10)	05' 00	7
	30	5
(11)	06' 00	3

Lin & Lin

"B"

1h	13' 00"	70 charge
	33 00"	80 "
	23	105 disch
	10	100
	20	95
	30	85
	40	82
	50	57
(1.)	24' 00	56
	15	52
	30	45
	45	44
(2.)	25' 00	40
	15	37
	30	34
(3.)	26' 00	32
(4.)	27' 30	30
	00	25
	30	26
(5.)	28' 00	25
	30	23
(6.)	29' 00"	22
(7.)	30' 00"	20
(8)	31' 00"	18
	30	16
(9)	32' 00	10
	30	7
(10)	33' 00	3

1h	41' 00"	70 charge
	51' 00"	75 "
	51'	105 discharge
	10	100
	20	98
	30	85
	40	65
	50	63
(1.)	52' 00	61
	15	57
	30	56
	45	47
(2)	53' 00	43
	15	39
	30	35
(3.)	54' 00	30
	30	25
(4)	55' 00	26
	30	24
(5)	56' 00	23
	30	21
(6)	57' 00	20
(7)	58' 00	17
(8)	59' 00	14
	15	11
	30	8
	45	5
(9)	60' 00	4

3h	17' 00"	60	charge
	27 00	60	"
	27 -- 6	75	disch
	10	76	
	20	73	"
	30	72	
	40	71	
	50	69	
(1.)	28' -- 00	64	"
	15	59	
	30	53	
	45	48	
(2.)	29' -- 00	44	
	15	42	
	30	41	
(3)	30' -- 00	39	"
	30	37	
(4.)	31' -- 00	34	
	30	31	
(5)	32 -- 00	28	
	30	25	
(6)	33 -- 00	21	
	30	15	
	45	11	
(7)	34' -- 00	9	
	15	7	
	30	6	
	45	5	

3h	45' 00"	60	charge
	55 00	60	"
	55 -- 7	82	disch
	10	78	
	20	70	
	30	66	
	40	66	
	50	61	
(1.)	56 -- 00	59	
	15	56	
	30	50	
(2)	57' -- 00	46	
	30	43	
(3)	58' -- 00	42	
	15	38	
	30	35	
(4)	59' 00	33	
	30	30	
(5)	4' 00	28	
	30	24	
	45	20	
(6)	01 -- 00	15	
	15	11	
	30	5	
	45	6	
(7)	02' -- 00	5	
	15	4	

3h	19' 00"	40	charge
	29' 00	40	
	31 -- 5	72	disch
	10	67	
	20	64	
	30	61	
	40	55	
	50	49	
(1)	30' -- 00	46	
	15	43	
	30	38	
	45	35	
(2)	31' -- 00	33	
	15	32	
	30	30	
(3)	32 -- 00	26	
	15	18	
	30	12	
(4)	33' 00	6	
	30	3	

3h	35' 00"	40	charge
	45 00	40	
	45 -- 4	70	
	10	66	
	20	62	
	30	57	
	40	55	
	50	51	
(1.)	49' -- 00	46	
	15	42	
	30	39	
	45	35	
(2)	50' -- 00	33	
	15	31	
	30	30	
(3)	51' -- 00	25	
	30	25	
	45	21	
(4)	52 00	16	
	15	11	
	30	5	
	45	6	
(5)	53' 00	4	

5th 15', 00"	20 chains	
25 - 00"	20	
35 - 00	60 links	
10	55	
20	47	
30	30	
40	10	
50	6	
60	3	

Hedmarchen
Running 27 Chains

9th 31' 00"	20 chains	
31' 00"	20	
31 - 5	50 links	
10	46	
20	40	
30	36	
40	33	
50	29	
(1) 32 - 00	26	
15	23	
20	20	
45	16	
2. 33 - 00	11	
15	5	
50	3	

Wednesday 27th Cont'd

Determination of constant of galvanometer in use in preceding experiments.

Galvanometer in series with external resistance = d

" " " " shunt 5.2 ohms = d_1

" " " " " 10.4 " = d_2

d	d_1	d_2	
66	+3	5.2	right of zero
67	+3	5.2	
65	+3	5.2	
65	+1	5.0	left of zero
65	+1	5.0	
65	+1	5.0	
66	+2	5.1	} means

Then $(S+B) = \frac{R\,d_1}{d-d_1}$

$C = \frac{E}{S+B} = K d$

$\therefore K = \frac{E}{(S+B)\times d}$

where S+B = total resistance of circuit including galvanometer, battery & connections

$S+B = \frac{5.2\times 4.2}{66-4.2} = 9.1$ ohms

$S+B = \frac{10.4\times 2.1}{66-2.1} = 9.2$ ohms

} = 9.15 ohms

$Kd = C = \frac{1.079}{9.15} = .118$ amperes for 66 deflection

$\therefore K = .00175$

$Kd_1 = C_1 = \frac{1.079}{9.15+5.2} = .075$ amperes for 63 defl.

$\therefore K = .00175$

$Kd_2 = C_2 = \frac{1.079}{9.15+10.4} = .055$ amperes for 51 defl

$\therefore K = .00177$

mean value of K = .00175

i.e. d × .00175 = no. of amperes.

exposed surface of tin cheeks
= 1.2 sq inches.

charged with 50 × .00015 amperes for 10"
= .100 amperes

or $\frac{.100}{1.2}$ = .09 per sq inch.

and returns 45 %
= .04 amps per sq in.

14183/4.
G 8
750

Menlo Park Notebook #240 [N-81-03-04]

This notebook covers the period March 1881. The entries relate to tests made of a Hampson engine running a dynamo. The author is unknown. The label on the front cover is marked "Hampson Engine." The book contains 280 numbered pages.

Blank pages not filmed: 4-273, 278-280.

10 :: 28 :: 485

225
3480
870
121 80

10 :: 28 :: 485

LIBRARY OF THE

BOARD OF PATENT CONTROL,

120 BROADWAY, NEW YORK.

~~From Library~~
GENERAL PRINTING
44 Broad St. N.Y.
May 1, 1896

Mens. Bo R Mch 4 1891

Started Harrison Engine
with Sixty Lamps.
Engine running at 485 Revs
Mch 4th Run 8 hr
" 5 " 11 "
" 7 Run 7 "
" 10 Run 4 "
" 11 Run 11 "
" 12 " 10 "
" 14 " 11
" 15 " 17
" 16 " 13
" 17 " 12
" 18 " 12 " Lamp broke
burning 108 hr

Mar 19 1881
report of the working of
hampson engine

Mar 19	run 10	hrs	435	r.p.	1218	warpths	
" 21	" 4	"	"	"	"	"	
" 23	" 10	"	"	"	"	"	
" 24	" 10	"	"	"	"	"	
" 25	" 18	"	"	"	"	"	
" 26	" 10	"	"	2 tons brake			

Strengthening field
March 17 / 88.

Curve Test of field mags
Prof. Sten[illegible] Forward

def field Mag	deflection armature	Engine Speed	Remarks
	~~3~~	~~240~~	~~[illegible]~~
13	24.5 @ 24	222	feeble on 1st strength
30	37.	209 @ 10 @ 207	
35	38	205	increased speed him of Engineer
42	52	232 @ 242	this last speed was for field —
48	57.	240	wires in field, speed 233.
66:	63	228	
70½	60	211	
72	65	230	
80.	62	207.	
78	67	212	
84	65	216	
27	71	200.	— pulley on thompson shaft

Pulley on Wetfield mac
Not loose

20 Cells gur 32°

def Mag	armature	Eng Speed
200	73	207
going down — breaking field		
173	70	216
167	70½	216
50	60	224
40	56	232
28	45	242
20	40	226.

We now go up again -

EMF Field Mag	EMF armature	Engine Speed	Remarks
open	40	247	Circuit field open
39	50	236	field on
65	60	228	
120	70	214	
176	75	219	
177	76	214	76 is as far as he can change
	Take off field		
We go up again -			
open	40	252	
30	45	241	
	~~50~~	~~250~~	
39	50	244	
50	55	240	
60	60	230	
	~~65~~	~~224~~	
50	66	265	
112	70	216	

going to take EMF of field + gradually increase speed Engine see if it effects field =

115 = speed eng - 219.
111½ " " 283
113 - " " 320

-45 or

We run the Engine. 628.

def 215 — 145 volts

Menlo Park Notebook #244 [N-81-02-18]

This notebook covers the period February-March 1881. The entries are by Francis Jehl and relate to resistance tests of experimental lamps. The label on the front cover is marked "Experimental Lamps" and "Francis Jehl." There is an index on the inside front cover. The book contains 282 numbered pages.

Index.

Experimental Lamps.

Order No 5 = 186 to 193, 196, 197, 199, 200.
" " 6 = 182, 184, 185.
" " 12 = 198, 201.
" " 20 = 181, 194, 195.
" " 39 = 202 to 220.
" " 192 = 54 to 101.
" " 195 = 37 to 53.
" " 194 = 148.
" " 195 = 149.
" " 196 = 150.
" " 198 = 102 to 147.
" " 202 = 1 to 3.
" " 221 = 231 to 266.
" " 222 = 151 to 173.
" " 10×17 = 4 to 36, 183.
Dr. Maick's Lot = 221 to 230.
Graphite " = 174 to 180.
Cigular " = 267 to 283.

Feb. 18, 1881.
Order 202 - 104½ V
16(A)

1

113.40 V 48 e

256 d
7.703 R

y fig

Index.

Experimental Lamps.

Order No 5 – 186 to 193, 196, 197, 199, 200.
" " 6 – 182, 184, 185.
" " 12 = 198, 201.
" " 20 = 181, 194, 195.
~~" " 39 = 202 to 220~~

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120 BROADWAY, NEW YORK.

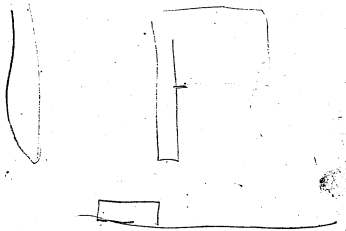
From Library
44 Broad St N.Y.
Nov 1, 1896

" " 10×17 = 4 to 36, 183.
Dr. Maidi's Dot = 221 to 230.
Graphite " = 174 to 180.
Regular " = 267 to 283.

Feb. 18, 1881.
Order 202 – 104½ V
16(A)

113.40 V 48 C
256 0
7.700 A

busted by flug



Feb. 18, 1881.
Order 202—101½ V
8B

Meter 46 C

12500
8100 R

200 / 2 0 6 6 0
1 0 3 60
200

104
130
3120
104
115 / 1 3 5 2 0 / 117
115
202
115
870
805
65

118
104
14 Ohms inserted.

Feb. 18, 1881.
Order 202—109 V
8A

118/25 46 C

12500
9500 R

200 / 2 2 0 6 0
1 1 0 60
200

111
130
3330
111
118 / 1 4 4 3 0 / 122
118
263
236
270
236
34

122
111
11 Ohms inserted.

Feb. 19, 1881.
115 1365 18 C

12560
88-00 Q

200 / 20860
104 60/200

105
130
3150
105
115 / 13650 / 118
115
215
115
1000
920
80

119
105
14 Ohms inserted.

Mar. 3, 1881.
Reflection of E scale.
05/25

18C 495

Mar. 3, 1881.
12 - 10×17

10c 49V

Mar. 3, 1881.
21 - 10×17

10c busted 1

Mar. 3, 1881.
Reflection of ⅔ scale.
3rd ⅔

10C ~~10~~ 49 ✓

Mar. 3, 1881.
11—16×17

10C 49.9 ✓

Mar. 3, 1881.
10 – 10 X 17

10 e 49.9 v

Mar. 3, 1881.
5 – 10 X 17

10 e 48.6 v̄

Mar 3 1881.
20 – 10×17

10C 47.93V

Mar 3 1881.
19 – 10×17

10C 52.65V

Feb. 26 1881.
18 — 10x17.

10e · 48.6v

Feb. 26 1881.
3 — 10x17

10e 49.9v

Mar. 3, 1881.
27 — 10×17

10 C 48.6 V

Mar. 3, 1881.
2 — 10×17

10 C · 48.6 V

Feb. 28 1881.
29 – 10×17

10C 49.9V

Mar. 3, 1881.
28 – 10×17

10C 46.5V

March, 1881.
17 – 10X17

10C 49.27 V

March, 1881.
15 – 10X17

10C 48.60 V

Mar 3, 1881.
1 — 10×17

10C 47.25V

Mar. 3, 1881.
23 — 10×17

10C 47.93V

Mar. 3, 1881.
22 — 10×17

10 C 4 r 16 v

Mar. 3, 1881.
4 — 10×17

10 C 4 9 9 r

Mar. 3, 1881.
7 — 10×17

10 C — 50.6 V

Mar. 3 1881.
9 — 10×17

10 C + 8160 V

Mar. 3, 1881.
10 — 10×17

10 C 49.9 V

Mar. 3, 1881.
13 — 10×17

10 C 48.6 V

Mar. 3, 1881.
14 – 10×17

busted, no
vacuum

Mar. 3, 1881.
26 – 10×17

103 49.95 ✓

Mar. 3, 1881.
22 – 10×17

10C 47,255

Mar. 3, 1881.
21 – 10×17

10C. 48,6V

Mar. 3, 1881.
20 - 10×17

10C [illegible]
[illegible]

Mar. 3, 1881.
19 - 10×17

10C [illegible]

March 3, 1881.

15 - 10 x 17

10 C 47.25

Feb 28 1881.

105 1/2 V - Order 193

118 12 V

12560 R

8100

200 | 20660

103 60

200

4 K C

104

130

3120

104

118 | 13520 | 114

118

172

118

540

472

68

115

104

11 Chemisinetto.

Feb. 25, 1881.
Order 193 – 111½ v
25

120.82 v

18540
3700 R

200 | 22540
11 | 2 1140
200

48 0

113
130
3390
113
121 | 14690 / 121
121 113
2569
2422
170
121
49

8 Chins inserted.

Feb. 25, 1881.
Order 193 – 103½ v
3

713.40 v

18540
3900 R

200 | 22740
11 | 3 1140
200

48 0

113
130
3390
113
113 | 14690 / 130
113 114
339
339
0

16 Chins inserted.

Feb. 25/1881.
Order 193-106½ U
18

114.07 V

18840
2500 R
21340

4 V C

200/21340
106 140
200

107
130
3210
107
114/13910 122
114 107
251 15 Chins inserted.
228
238
228
2

Feb. 25/1881.
Order 193-106½ U
28 (A)

119.47 V

18840
3500 R
22340

4 8 C

200/22340
111 140
200

112
130
3360
112
119/11560 122
119 112
266 10 Chins inserted.
238
280
238
42

Feb. 28/1881.
Order 193-104 U
5

115 12 U

18840
3900 A
22740
48 C

200/22740
113 140
200

114
130
3420
114
118/14820/125
118
302
236
660
590
70

126
114
12 Chun inverted.

Feb. 28/1881.
Order 193-105 U
22

121 50 U

18840 A
200
21840
48 C

200/21840
109 140
200

109
180
3270
109
122/14170/116
122
192
122
750
732
18
109
7 Chun inverted.

Feb. 28, 1881.
Order 193 – 105½ V
2

120.82 V

18840
3600 R
22440
48 C

200 | 22440
112 | 440
200

112
130
3360
112
121 | 14560 | 120
121 | 112
246
242
40

8 Ohms inserted.

Feb. 28, 1881.
Order 193 – 109½ V
26

122.14 V

18840
3400 R
48 C

200 | 22240
111 | 40
200

111
130
3330
111
122 | 14430 | 118
122 | 111
228
122
1010
976
34

7 Ohms inserted.

Feb. 28 1881.
Order 193-105 U
4

122,85 V

18840 U
4200 R
23040

48 e

200/23040
115 40
200

115
130
3450
115
123/14950/121
123
265
244
210
123
97

122
115
7 Chime inserted.

Feb. 28 1881.
Order 193-106½ U
30

122,85 V

18840 U
4200 R
23140

48 e

200/23140
115 140
200

116
130
3480
116
123/15080/122
123
278
246
320
246
74

123
116
7 Chime inserted.

Feb. 28, 1881.
Order 193 – 104½ Q
13

118.12 V

14540
2600 R
21440

48 C

200 / 21440
102 40
200

102
130
3060
102

118 / 13260 / 112
118 102
146 10 Chme inverted.
118
280
236
44

Feb. 28, 1881.
Order 193 R — 111½ C
15

124.83 V

18840
52000 R
24040

48 C

200 / 24040
120 40
200

120
130
3600
120
125 / 15600 / 124
125
310
250
600
500
100

125
120
5 Ohms inserted.

Feb. 28, 1881.
Order 193 — 115½ C
16

128.25 V

18840
40000 R
22840

48 C

200 / 22840
114 40
200

114
130
3420
114
128 / 14820 / 115
128
202
128
740
640
100

116
114
2 Ohms inserted.

Feb. 28, 1881.
Order 193 – 102½ V
9

116.10 V

18640
2300 R

48 C

200 / 21140
105 140
200

106
130
3180
106
116 / 13786 / 118
116
218
116
1020
928
92

119
106
13 Ohms inserted.

Feb. 28, 1881.
Order 192 – P 650
105½ V – 6B

114.75 V

18640
3400

22240

48 C

200 / 22240
111 40
200

111
130
3330
111
115 / 14430 / 125
115
293
230
630
575
55

14 Ohms inserted.

Feb. 25, 1881.
Order 192 – R 267
105 V – C.A.

113 40 V.

18 8 4 0
1 0 0 0

19 8 4 0

48 C

200 / 19840
99 40/200

99
130
2970
99
113 / 12870 / 113
113
157
113
440
339
101

114
99
15 Ohms inserted.

Feb. 26, 1881.
Order 192 – R 280
106 V – 14 A

114.75 V

18 8 4 0
2 0 0 0

20 8 4 0

48 C

200 / 20840
104 40/200

104
130
3120
104
115 / 13520 / 117
115
202
115
870
805
65

118
104
14 Ohms inserted.

Feb. 28, 1881.
Order 192 — R 260°
107½ V — 15 A

114.75 V

18840
9900 R
19740

48 C

200/19740
98140
200

99
130
2970
99
115/12870/111
115
137
115
220
115
105

112
99
13 Ohms inserted.

Feb. 28, 1881.
Order 192 — R 670
106 V — 16 A

113.40 V

18840
11000 R
19940

48 C

200/19940
99140
200

100
130
113/13000/115
113
170
113
570
565
5
100
15 Ohms inserted.

Feb. 28, 1881.
Order 192 – R 650
108½ V – 25 A

117.45 V

18840
2300 R

200 / 21140
105 / 140
200

48 C

106
130
3180
106
117 / 13780 / 117
117
208
117
910
819
91

118
106
12 Ohms inserted.

Feb. 28, 1881.
Order 192 – R 1000
110½ V – 28 A

118.12 V

18840
2800 R

21640

48 C

200 / 21640
108 / 40
200

108
130
32240
108
118 / 14040 / 118
118
224
118
1060
944
116

119
108
11 Ohms inserted.

Feb. 26 1881.
Order 192 – R 280
109 V – 21 A

114.07 V

18840
1400 R
20240
48 C

200 / 20240
101 / 40
200

101
130
3030
101
114 / 13130 / 115
114 / 101
173
114
590
570
20

14 Ohms inserted.

Feb. 26 1881.
Order 192 – R 290
114½ V – 14 B

111.34 V

18840
1400 R
20240
48 C

200 / 20240 / 1
101 / 40
200

101
130
3030
101
111 / 13130 / 118
111 / 101
203
111
920
888
32

17 Ohms inserted.

Feb. 26 1881.
Order 192 – R 1000
110½ V – 16 A

114.07 V
18840
3100 R
21940
48 C

200 / 21940
109 140
200

110
130
3300
110
114 / 143000 / 125
114
290
228
620
570
50
110
15 Ohms inserted.

Feb. 28 1881.
Order 192 – R 670
109 V – 16 B

115.48 V
18840
2400 R
4 C

200 / 21240
106 40
200

106
130
3180
106
115 / 13780 / 119
115
228
115
1130
1035
95
120
106
14 Ohms inserted.

Feb. 28/1881.
Order 192 – R 685
111 U – 8 A

121150 U

18540
5700 R

239400

48 C

200/239400
119 140
200

120
130
3600
120
122/15600/127
122
340
244
960
854
106

128
120

8 hours inserted.

Feb. 1881.
Order 192 – R 280
111½ U – 11 A

118112 U

18540
2200 R

21040

H R C

200/21040
105 40
2100

105
130
3150
105
115/13650/115
115
195
115
670
575

116
105
11 hours inserted

Feb. 28, 1881.
Order 192 – R 245
112½ – 7A

118.125

18840
1600 R

48 e

118.8

18840
1.200 R

20040

48 e

200/20040
100 40
200

100
130

119/13000/109
119 108
1100
1071
29

9 Chines inverted.

Feb. 28, 1881.
Order 192 – R 710
109U – 17A

118.12

18840
1600

200/20490
102 90

48 e 200

103
130
3690
103

118/13390/113
118
159
118
410
354
56

114
103
11 Chines inverted.

Feb. 1881.
Order 192 - R 950
104 U - 26 A

No connection

Feb. 28 1881.
Order 192 - R 260
111 U - 25 B

112.72 V

~~16840~~

12560
6200 R

18760
48 C

200 / 18760
93 160
200

94
130
2820
94
113 / 12220 / 108
113 97
9204 11 Cinc. incertos.
16

Feb. 25 1881.
Order 192 - R 295
104 V - 12 A

114.75 V 48

12560
7500 R

200 / 19960
99 160
200

97
130
2910
97

115 / 12610 / 109
115
1110
1035
75

110
97
13 Ohms inserted.

Feb. 25 1881.
Order 192 - R 730
117 V - 11 B

118.12 V 48 C

12560
9000 R

200 / 21560
107 160
200

108
130
3240
108

118 / 14040 / 118
118
224
118
1060
944
116

114
108
11 Ohms inserted.

Feb. 28 1881.
Order 192 - R 255
110½ U - 5B

115.485 48C

12560
7500 R

200 / 20060
100 60
200

100
130

115 / 13000 / 113
115 100
150 13 Chines inserted.
115
350
345
5

Feb. 28 1881.
Order 192 - R 820
108 U - 17B

110.62 V 48C

12560
7700 R

200 / 20260
101 60
200

101
130
3030
101

111 / 13130 / 118
111 101
203 17 Chines inserted.
111
920
888
32

Feb. 28 1881.
Order 192 - R365
106½ U-7B

119.47 v 48c

12560 R
9100

200 / 21660
108 60
200

108
130
3240
108
119 / 14040 / 117
119
2141
119
950
833
117

118
108
10 Chines inserted.

Feb. 28 1881.
Order 192 - R355
105½ U-19A

121.50 v 4v

12560 R
7800

200 / 20360
101 160
200

102
130
3060
102
122 / 13260 / 108
122
1060
976
84
122

109
102
7 Chines inserted

Feb. 25 1881.
Order 192 - R330
105½ U - 13

116.77 r 48 c

12560
7800 R

200/20360
101 180
200

102
130
3060
102
117/13260/113
117 102
156 14 Chins inserted.
117
390
351
39

Feb. 26 1881.
Order 192 - R360
101 U - 2

114.75 r 48 c

12520
7300 R

200/20860
104 60
200

104
130
3120
104
115/13520/117
115 118
202 104
115 14 Chins inserted.
870
805
65
115

Feb. 28, 1881.
Order 192 – R 365
105½ V – 14 C

117.45 V 48 C

12560 R
92000
200 | 21760
103 160
200
104
180
3120
104
117 | 13520 | 115
117
182
117
650
585
65

116
104
12 Ohms inserted

Feb. 28, 1881.
Order 192 – R 350
117½ V – 20 A

126.22 V 248 C

12560 R
~~9000~~
200 | 20560
102 160
200
103
180
3090
103
126 | 13390 | 106
126
790
756
34
126

3 Ohms inserted

Feb. 28 1881.
Order 192 - R 840
106 V - 28 B

114,755 48 C

12560
6100 R

200 / 19260
96 60
200

97
130
2910
97

115 / 12610 / 109
115
1110
1035
75
115

110
96
14 Ohms inserted.

Feb. 28 1881.
Order 192 - R 330
106 V - 19 B

121,505 48 C

12560
7300 R

200 / 19860
99 60
200

99
130
2970
99

122 / 12870 / 105
122
670
610
60
122

99
6 Ohms inserted.

Feb. 28, 1881.
Order 192-R 345
109 V-21 B

118,125 48C

18840
3700 R

200/22540
112 140
200

113
130
3390
113

118/14690/124
118
289 125
236 113
530 12 Ohms inverted.
472
58
118

Feb. 28, 1881.
Order 192-R 320
105 V-27 (A)

114,175 48C

1500
18840 R

200/20340
101 140
200

102
180
3060
102

115/13260/115
115 102
176 13 Ohms inverted.
115
610
575
35

Feb. 28, 1881.
Order 192 – R 340
101 U – 20 B

114.07 V 48 C

18840
190 0 R

200 / 20740
103 140/200

104
130
3120
104
114 / 13520 / 118
114
212
114
980
912
68
114

119
104
15 Ohms inserted.

Feb. 28, 1881.
Order 192 – R 350
106 U – 27 (B)

116.10 48

18840
170 0 R

200 / 20540
102 140/200

103
130
3090
103
116 / 13390 / 115
116
179
116
630
580
50
116

103
12 Ohms inserted.

Feb. 25, 1881.
Order 192 – R325
950 – 14 D

116.10 V 48 C

1900
18840 R

200 / 20540
102 140
200

103
130
3090
103
116 / 13390 / 115
116 103
179 12
116
630
580
50
116

12 Ohms inserted.

Feb. 25, 1881.
Order 192 – R385
108½ V – 15 B

120.82 V 48 C

18840 R
1700

200 / 20540
102 170
200

103
130
3090
103
121 / 13390 / 110
121
129 111
121 103
80
121

8 Ohms inserted.

Feb. 28, 1881.
Order 192 — R 860
106½ V — 160

117,145 V 48 C

~~17~~ R

1900
18840

200 | 20740
103 140/200

104
130
3120
104
117 | 13520 | 115
117
182
117
650
585
65
117

116
104
12 Chins inserted.

Feb. 28, 1881.
Order 192 — R 200
102 V — 29

11407 V

18840
2200 R

200 | 21040
105 40/200

105
130
3150
105
114 | 13650 | 119
114
225
114
1110
1026
84
114

120
105
15 Chins inserted.

Feb. 25, 1881.
Order 192-R 315
High-28 B

130 V 33 C

18840
2700 R

200 / 21540
107 140
200

108
130
3240
108
130 / 14040 / 108
130
1140
1140

Feb. 25, 1881.
Order 192-R 333
110 V - 4A

121.50 V 48

18440 R
4800

200 / 23740
118 140
200

119
130
3570
119
122 / 15470 / 126
122
327
244
830
732
98
127

127
119
8 Can winnow too.

Feb. 28, 1881.
Order 192-R 350
105½ V-16D

116.77 V 48 C

18840
2900 R

200 / 21740
108 140
200

109
130
3270
109

117 / 14170 / 121
117 109
247 12 Ohms inserted.
234
130
117
13
117

Feb. 28, 1881.
Order 192-R 365
108½ V-24

115.43 V 48 C.

18840
2900 R

200 / 21740
108 140
200

109
130
3270
109

115 / 14170 / 123
115 109
267 14 Ohms inserted.
230
370
345
25
115

Feb. 25, 1881.
Order 192 – R355
103 V – 30

114.07 V 48 C

18840
900 R

200 / 19740
98 140
200

99
130
2970
99
114 / 12870 / 112
114
147
114
330
228
102
114

113
99
14 Ohms inserted.

Feb. 7, 1881.
Order 192 – R340
105½ V – 123

113.40 V 48 C

18840
2200 R

200 / 21040
105 40
200

105
130
3150
105
113 / 13650 / 120
113
235
226
90
113

121
105
16 Ohms inserted.

Feb. 26 1881.
Order 192 – R345
106 U – 1A

114.75 V 48 C

18840 R
1600

200 / 20440
102 40/200

102
130
3060
102

115 / 13260 / 115
115 102
176 13 Ohms inserted.
115
610
575
35
115

Feb. 26 1881.
Order 192 – R305
107 U – 5 C

113.40 V 48 C

18840 R
200.

200 / 20040
100 40/200

100
130
3000
100

113 / 13000 / 115
113 100
170 15 Ohms inserted.
113
570
565
5
113

Feb. 28, 1881.
Order 192 – R 320
106½ Ω – 10 B

118.12 V 48 C

18640 P
1960

200/20 7 4 0
10 3 140
200

104
130
3120
104
118/35 20/114
118
172
118
540
472
68
118

115
104
11 Ohms inserted.

Feb. 28, 1881.
Order 192 – R 340
111½ Ω – 5 D

121.50 V 48 C

18840 P
1100

200/199.40
99 140
200

130
122/13000/106
122
800
732
68
122

107
100
7 Ohms inserted.

Feb. 28, 1881.
Order 192-R 350
112½ Ω - 1B

120.15 r 48 C

18540 R
2500

200/21340
106 140
200

107
130
3210
107

120/13910/115
120
191
120
710
600
110
120

116
107
9 Ohms inserted.

Feb. 28, 1881.
Order 192-R 350
108½ Ω - 4B

114.75 r 48 C

18548 R
2300

200/21140
105 140
200

106
130
3180
106

115/13780/119
115
228
115
1130
1035
95
115

120
106
14 Ohms inserted

Feb. 28, 1881.
Order 198-R 450
112½ U-11

120.15 r 45c

18540 R
2100

200/20940
104 140
200

105
130
3150
105
120/13650/113
120
165
120
450
360
90
120

114
105
9 Chs inserted.

Feb. 28, 1881.
Order 198-670
110 U-9A

114.75 r 45c

18540 R
1700

200/20540
102 140
200

103
130
3090
103
115/13390/116
115
189
115
740
690
50
115

103
13 Chs inserted.

Feb. 28, 1881.
Order 198 – R 500
114½ U – 4

118.125 r 48 C

15440 R
2950

200 | 21740
108 140
200

109
130
3270
109

118 | 14170 | 120
118 109
237 11 Chins inserted.
236
10
118

Feb. 28, 1881.
Order 198 – R 560
High – 1 A

128.125 r 48 C

15440 R
2650

200 | 21440
107 40
200

107
130
3210
107

128 | 13910 | 108
128 109
1110 107
1024 2 Chins inserted.
86
128

Feb. 28, 1881.
Order 198 – R 730
103 U – 2 A

120115 V 48 C

18840 R
3400

200 | 2 2 2 4 0
1 1 1 40
200

111
130
3330
111
120 | 14430 | 120
120 111
2430 9 Chins inserted.
2400
30
120

Feb. 28 1880.
Order 198 – R 650
110½ U – 16

113.40 48 C

18840 R
2300

200 | 2 1 1 4 0
1 0 5 140
200

106
130
3180
106
113 | 13780 | 121
113 122
2480 106
2260 16 Chins inserted.
2200
113
107

Feb. 28, 1881.
Order 198 – R395
111/2 U – 13 A

114.75 V 48 C

18840 R
1760

200 | 19940
99 140
200
100
180

115 | 13000 | 113
115 100
150 13 Ohms inserted.
115
350
345
5
115

Feb. 28, 1881.
Order 198 – R560
114 1/2 U – 3 A

118.80 V 48 C

18540
8200 R

20 | 22140

110 40
200

110
130
3300
110

119 | 14300 | 120
119 110
240 10 Ohms inserted.
238
20
119

Feb. 28, 1881.
Order 198 – R 800
110½ U – 8 A

116.10 V 48 e

18840 R
2900

200 / 2 1 7 4 0
1 0 3 140
200

104
130
3120
104
116 / 1 3 5 2 0 / 116
116
192 117
116 104
760 13 Ohms inserted.
696
64
116

Feb. 28, 1881.
Order 198 – R 590
112½ U – 2 B

116.10 V 48 e

2900 U
18840 R

200 / 2 1 7 4 0
1 0 3 140
200

103
130
3090
103
116 / 1 3 9 0 / 115
116 104
179 11 Ohms inserted.
116
630
580
50
116

Feb. 28, 1881.
Order 198 – R 430
110½ V – 7 A

114.07 V 48 C

18540 R
1300

200 / 20140
100 140
200

101
130
3030
101

114 / 13130 / 115
114 101
173
114
590
570
20
114

14 Ohms inserted.

Feb. 28, 1881.
Order 198 – R 670
104½ V – 1 B

114.07 V 48 C

18540 R
2000

200 / 21840
109 40
200

109
130
3270
109

114 / 14170 / 124
114 109
277
228
490
456
34
114

15 Ohms inserted.

Feb. 28, 1881
Order 198 — R550.
114½ U - 5 A

118,125 V 48 C

18540 R
2700

200 / 21540
107 140
200

108
130
3240
108

118 / 14040 / 118
118
224
118
1060
944
116
118

119
108
11 Ohms inserted.

Feb. 28, 1881.
Order 198 — R445
103½ - 12 A

108,1 V 48 C

18840 R
1300

200 / 20140
100 140
200

101
130
3030
101

108 / 13130 / 121
108
233
216
170
108
62
108

122
101
21 Ohms inserted.

Feb. 28 1881.
Order 198 – R 600
107½ U – 15 A

111.34 V 48 C

18840 R
2000

200 / 2 0 8 4 0
104 40 / 200

104
130
3120
104

111 / 13520 / 121
111
242
222
200
111
89
111

122
104
18 Ohms inverted.

Feb. 28 1881.
Order 195 – R 615
113½ U – 15 B

120.82 V 48 C

18840 R
4300

200 / 23140
115 140 / 200

116
180
3480
116

121 / 15080 / 124
121
298
242
560
484
76
121

125
116
9 Ohms inverted.

Feb. 28, 1881.
Order 198-R 650
106 U-9B

110.02 U 48 C
18840 R
1600

200 / 20540
102 140
200

102
130
3060
102

110 / 13260 / 120
110
226 121
220 103
60 18 Chains inserted.
110

Feb. 25, 1881.
Order 198-R 510
113 U-8B

121.50 U 48 C
18840 R
4200

200 / 23040
115 40
200

115
130
3450
115

122 / 14950 / 122
122 115
275 7 Chains inserted.
244
310
244
66
122

Feb. 28 1881.
Order 198 – R600
108 V – 10 A

111.34 V 48 C

18840 P
1200

200 | 200 40
100 40
200

100
180

111 | 18000 | 117
111 100
190 17 Ohms inserted.
111
790
777
13
111

Feb. 25 1881.
Order 198 – R612
112½ V – 29

117.145 V 48 C

18840 P
3300

200 | 2 2 1 40
1 1 0 120
200

111
180
3300

117 | 1144 | 123
117 111
273 12 Ohms inserted
234
390
351
39
117

Feb 28 1881.
Order 198 – R 650
High – 20

130 V 48

18840 R
4600

200 / 23440
117 40
3.00

117
180

3510
117

130 / 15210 / 117
130

221
180

910
910

Feb 28, 1881.
Order 198 – R 620
109½ V – 22

115143 V 480

18840 R
2300

200 / 21140
100 200

101
130

3030
101

115 / 13130 / 114
115 101
13 Crime inserted.

163
115

480
460

20
115

Feb. 28, 1881.
Order 195 — R605
106 V — 13 B

111.34 V 48 C

188 40 R
12 00

200 / 20 0 40
100 40
200

100
130
111 / 13 000 / 117
111 100
190 17 Ohms inserted.
111
790
777
13
111

Feb. 28, 1881.
Order 195 — R410
106½ V — 30 A

113.40 V 48 C

188 40 R
13 00

200 / 20 1 40
100 140
200

101
130
3030
101
113 / 13 130 / 116
113 101
183 15 Ohms inserted.
113
700
678
22
113

Feb. 26 1881.
Order 198 - R590
High - 3 B

130 V ~~26~~ 28 C

18840
~~5800~~ R

200 / 2 3 8 4 0
1 1 9 40
200

119
130
3570
119
130 / 15470 / 119
130
247
130
1170
1170

Feb. ~~28~~ 1881.
Order 198 - R460
1080 - 13 C

1081 V 48 C

18840
2500 R

200 / 2 1 3 4 0
10 1 140
200

102
130
3060
102
108 / 13260 / 122
108
246
216
300
216
84
108

123
102
21 Ohms inserted.

Feb. 28 1881.
Order 198 - R 490
108 U - 12 B

112.72 V 48 C

18840 R

1100

200 / 19940
99 140
200

100
130

113 / 13000 / 115
113 100
170 15 Ohms inserted.
113
570
565
5
113

Feb. 28 1881.
Order 198 - R 590
106½ U - 10 B

113.40 V 48 C

18840 R

1000

200 / 19840
99 40
200

99
130
2870
99

113 / 12870 / 113
113 99
157 14 Ohms inserted.
113
340
339
1
113

Feb. 28 1881.
Order 198 - R585
105 - 3 C

112.72 V 48 C

18840 R
1200

200 / 20140
100 140
200

101
130
3030
121

113 / 13130 / 116
113 101
183 15 Ohms inserted.
113
700
678
22
113

Feb. 28 1881.
Order 198 - R570
111½ V - 130

119.47 V 48 C

18840 R
2900

200 / 21740
108 140
200

109
130
3270
109

119 / 14170 / 119
119 109
227 10 Ohms inserted.
119
1080
1071
9
119

Feb. 27 1881.
Order 198 – R560
103 U – 3 C

116177 V 48 C

18540 R
3700

200/22 5540
112 140
200

113
130
3390
113
117/14690/125
117
299 126
234 113
650 13 Ohms inserted.
585
65
117

Feb. 27 1881.
Order 198 – R565
110½ U – 9 C

115148 V 48 C

18540 R
2700

200/21 5540
107 140
200

108
130
3240
108
115/14040/122
115 108
254 14 Ohms inserted.
230
240
230
10
115

Feb 6th 1881.
Order 198 - R560
High - 24

125550 V 48 C
18840 R
1700

200 / 20540
102 140
200

103
130
3090
103

126 / 13390 / 106
126 103
790
756
34
126

3 Ohms inserted.

Feb 6th 1881.
Order 198 - R560
103 Ω 22

113400 V 48 C

1800
18840 R

200 / 20640
103 140
200

103
130
3090
103

113 / 13390 / 118
113 103
209
118
960
904
56
113

15 Ohms inserted.

Feb. 28, 1881.
Order 198-R 540
109 J-B7

118.12 V 48 C

18840
3100 R

200 / 21940
109 140
200

110
130
3300
110

118 / 14300 / 121
118 110
250 11 Chins inserted.
236
140
118
22
118

Feb. 28 1881.
Order 198-R 265
105 U-C8

113.40 V 48 C

18840
2600 R

200 / 21640
108 40
200

108
130
3240
108

113 / 14040 / 124
113 108
274 16 Chins inserted.
226
480
452
28
113

Feb. 28, 1881.
Order 198 - R585
107 V - 26

114.75 V 48 C

18840 R
200

200/19640
98 40/200

98
130
2940
98

115/12740/110
115
124
115
90
115

111
98
13 Ohms inserted.

Feb. 28, 1881.
Order 198 - R720
109½ V - 15 C

116.77 V 48 C

18840 R
2800

200/21640
108 40/200

108
130
3240
108

117/14040/120
117
234
234
0

108
12 Ohms inserted.

Feb. 7, 1881.
Order 198-R575
1050U-70C

116,10V 48C

18840 U
2500 R

```
200/21340
    106 140
        200
     107
     130
    3210
     107
116/13910/119
    116
     231     120
     116     107
     1150     13 Ohms inserted.
     1044
      106
      116
```


Feb. 7, 1881.
Order 198-R370
1115-18A

120,82V 48C

18840 U
1700 R

```
200/20540
    102 140
        200
    103
    130
   3090
    103
121/13390/110
    121
     129     111
     121     104
      80      7 Ohms inserted.
      121
```

Feb. 28, 1881.
Order 198-R575
109 V-30 B

114.75 V 48 C

188.40
19 00 R

200 / 20740
103 140
200

104
130
3120
104

115 / 13520 / 117
115
202
115
870
805
65
115

118
104
14 Ohms inserted.

Feb. 28, 1881.
Order 198-R585
106 V-5 B

114.07 V 48 C

188.40
7001 R

200 / 19540
97 140
200

98
130
2940
98

114 / 12740 / 111
114
134
114
200
114
86
114

112
98
14 Ohms inserted.

Feb. 28, 1881.
Order 198 - R 560
113½ V - 7C

121.50 V 4 & C
14 & 40 R
2800

200 / 21 640
108.40
200

108
130
3240
108

122 / 14040 / 115
122 108
184
122
620
610
10
122

7 Ohms inserted.

Feb. 28, 1881.
Order 198 - R 675
111 V - 7D

114.07 V 4 & C
18540
8200

200 / 22040
110.40
200

110
130
3300
110

114 / 14300 / 125
114 110
290
228
620
570
50
114

15 Ohms inserted.

Feb. 25, 1881.
Order 198 – R 580
112/2 V – 28

122.17 V 48 e

18840 R
2200

200/21040
105 40/200

105
130
3150
105

122/13650/111
122
145
122
230
122
108
122

112
105
7 Chins inserted.

Feb. 25, 1881.
Order 198 – R 710
114 V – 18 B

122.17 V 48 e

18840 R
2200

200/21040
105 40/200

105
130
3150
105

122/13650/111
122
145
122
230
122
108
122

112
105
7 Chins inserted.

Feb. 28, 1881.
Order 194 - R 278
101 V - 17

121150 V 48 C

18840
26000 R

200 / 21440
107 40/200

107
130
3210
107
122 / 13910 / 114
122 107
171
122
490
488
2
122

7 Ohms inserted.

Feb. 28, 1881.
Order 195 - R 240
105 V - 29

118112 V 48 C

18840
4600 R

200 / 23440
117 40/200

117
130
3510
117
118 / 15210 / 128
118
341
236
1050
944
106
118

129
117
12 Ohms inserted.

Feb. 28, 1881.
Order 196 – R 305
114/2 V – 30

1305 34 C

18840 R
9150

200 / 27940
139 140/200

140
130
4200
140

130 / 18200 / 140
130
520
520
0

Feb. 26/1881.
Order 222 – R 396
No: 1

11,345

2540 R
2540

200 / 2 1 3 4 0
106 140/200

107
130
3210
107

111 / 13910 / 125
111
281
222
590
555
35

125
107
18 Chins inverto.

Feb. 28, 1881.
Order 222—R385
No. 2

111 / 3 4 5

18840
1000 R
19840

48 C

200 / 19840
99 40/200

100
130
111 / 13000 / 117
111 99
190 18 Ohms inverted.
111
790
777
13

Feb. 28, 1881.
Order 222—R333
No. 3

109 / 1 4 4 0

14440 R
1000
19440

4 8 C

200 / 19440 / 97
1800
1440
1400
40

97
130
2910
97
109 / 1261 0 / 115
109
171
109
620
545
95

116
97
19 Ohms inverted.

Feb. 28, 1881.
Order 222—R 399
No. 4

113.40 V

18440 R
17000 R

200 | 20540
48 102 140
200

103
130
3090
103
113 | 13390 | 118
113
209
113
960
904
56

119
102
17 Ohms inserted.

Feb. 28, 1881.
Order 222—R 391
No. 5

114.75 V

18600 R
17000 R

200 | 20540
48 102 140
200

130
103
115 | 13390 | 116
115
189
115
740
690
50

117
103
14 Ohms inserted.

Feb. 26 1881.
Order 222-R391
No. 6

110.52 V

R

56000
12560 R
200 / 118160
48 9 6 160
200

91
130
2730
91
110 / 11830 / 107
110
830
780
50

108
91
17 Ohms inserted.

Feb. 26 1881.
Order 222-R384
No. 7

111.34 V

12560 R
200 / 19460
48 9 60
200

98
130
2940
98
111 / 12740 / 114
111
164
111
530
444
86

115
98
17 Ohms inserted.

Feb. 28/881.
Order 222-R333
No. 8

105.85 V

12500 R
Hour

200 / 17360
1486 (160 / 200)

87
130
2610
87
106 / 13110 / 106
106
718
636
74

107
87
20 Ohms inserted.

Feb. 28/881.
Order 222-R185
No. 9

113.40 V

9500 R
12360

200 / 22060
1106 (60 / 200)

111
130
3330
111
113 / 14430 / 127
113
313
226
870
791
79

128
111
17 Ohms inserted.

Feb. 1881.
Order 222-R374
No. 10

118.12 V

8900 R
12560 R

200 / 2 1 4 6 0
48 / 0 7 6 0
200

108
130
3240
108

118 / 1 4 0 4 0 / 118
118
224
118
1060
944
116

119
108
11 Chains inserted.

Feb. 2 1881.
Order 222-R400
No. 11

114.75 V

12560
7600 R

200 / 2 0 3 6 0
48 / 1 6 1 1 6 0
200

102
130
3060
102

115 / 1 3 2 6 0 / 115
115
176
115
610
575
35

102
13 Chains inserted.

Feb. 2 1881.
Order 222 – R 399
No. 12

7800
12360

200 / 12 0 3 6 0
180 1 160
200

102
130
3060
102
112 / 1 3 2 6 0 / 118
112 102
206 16 Ohms inserted.
112
940
896
44

Feb. 7 1881.
Order 222 – R 349.
No. 13

108.V

6200
12560

200 / 1 2 5 6 0
48 94 60
200

95
130
2850
95
108 / 1 2 3 5 0 / 114
108 95
155 19 Ohms inserted.
108
470
432
38

Feb. 26 1881.
Order 222-R400
No. 14

112.725

66.3 R
26.3 R

200 | 19160
945 160
200

96
130
2880
96

113 | 12480 | 110
113
118
113
50

111
96
15 Ohms inserted.

Feb. 26 1881.
Order 222-R322
No. 15

106.675

66.00
12.560 R

200 | 19160
485 160
200

96
130
2880
96

109 | 12480 | 114
109
158
109
490
436
54

115
96
19 Ohms inserted.

Feb. 24, 1881.
Order 222 – R349
No. 16

113.40 V

7400

12560

200 | 19960
99 160
200

100
130

113 | 13000 | 115
113 100
170
113
570
565
5

15 Ohms inserted.

Feb. 24, 1881.
Order 222 – R391
No. 17

110.52 V

7500

12500 R

200 | 20060
1100 60
200

101
130
3030
101

110 | 13130 | 119
110 101
213
110
1030
990
40

18 Ohms inserted.

Feb. 2 1881.
Order 222-R318
No. 18

110.02 V

12560
6250 R

200 / 18760
93160
200

94
130
2820
94

110 / 12220 / 111
110
122
110
120
110
10

94
17 Ohms inserted.

Feb. 2 1881.
Order 222-R350
No. 19

106.65 V

12560
5600 R

200 / 18160
93160
200

91
130
2730
91

107 / 11830 / 110
107
113
107
60

111
91
20 Ohms inserted.

Feb. 28 1881.
Order 222-R287
No. 20

108,00 V

5900
12560 R

200 / 118460
489260
200

93
130
2790
93

108 / 12090 / 111
108
129
108
210
108
102

112
93
19 Ohms inserted.

Feb. 28 1881.
Order 222-R318
No. 21

116,10 V

12560
9400 R

200 / 21960
4880 89 160
200

110
130
3300
110

116 / 14300 / 123
116
270
232
380
346
34

110
13 Ohms inserted.

Feb. 26/881.
Order 222-R385
No. 22

111.34 V

7400
12560 R

200 | 11996 0
99 | 160
200

48

100
130
111 | 13000 | 117
111 | 100
190 | 17 Ohms inserted.
111
790
777
13

Feb. 26/881.
Order 222-R185
No. 23

112.72 V

5600
12560 R

200 | 11260
98 | 160
200

48

91
130
2730
91
113 | 11830 | 104
113 | 105
530 | 91
452 | 14 Ohms inserted.
78

Feb 28

No. 4 Graphite

24.97 Volts

$\frac{9100}{2333} = R$

6 ohm

$6 / 14000 / 2333$

$2333 / 9100 / 3$
6999
2101
2333 } = 4 Ohms

~~130 24.97 : 4 : X~~

or

$25.49 : 130 : 4 \quad X$

$25 / 520 / 20$
50
20
25
4
17 Ohms inserted

Graphite No 6

25.65 V

$\frac{9300}{X} = R$

$2333 / 9300 / 3$
6999
2301
2333 } = 4 Ohms.

130
4
$26 / 520 / 20$
52
0
4
16 Ohms inserted.

Problem No 5

27.√

$\frac{9980}{\sim} = R$

2333/9980/4 Ohms resistance.
9332
648
2333

130
4
27/520/19
27
250
243
7
4
15 Ohms inserted.

Problem No 7

27.√

$\frac{9700}{\times} = R$

2333/9700/4 Ohms resistance.
9332
368
2333

130
4
27/520/19
27
250
243
7
4
15 Ohms inserted.

Graphite No 3

22.28 V

8100 R

2333 / 8100 / 3 Ohms resistance.
6999
1101
2333

130
3
22 / 390 / 17
226
170
154
16

18
3
15 Ohms inserted.

Graphite No 8
23

35.10 V

busted burn R

Graphite No 9
busted in Coop.

Mar. 3. 1881.
52 C - 3 (20)
1/19/81 #8

62.15 24 C

12560
120

200 | 12690
63 90
200

63.7
130
18990
63
62 | 18990 | 132
62 63
199 69
186
130
124
6

62.2 : 120 :: 63
120

62 |

68 Ohms inverted.

Mar. 3, 1881.
55½ U-2
1/18/81 #6

24C 62.10 U

6279
5070 R
200/11349
56 149
200

57
130
1710
57
62/7410/119
62
121
62
590
558
32
62

120
57
63 Ohms inserted.

Mar. 3 1881.
53½ U-3
10×17

24C 26.10 U

6279 R
5100
11379

200/11379
56 179
200

57
130
1710
57
26/7410/285
52
57
228
228
208
130
130

Ohms inserted.

Mar. 3, 1881.
54½ V–6
(20)

24C 70.36V

6279
7800 R
200) 14079
70 79/200

89
130
70) 11400) 148
70
340
280
600
560
40
70

149
70
79 Ohms inserted.

Mar. 3 1881.
54½ V–10

24C 63.44V

6279
5900 R
200) 12179
60 179/200

61
130
1830
61
63) 7930) 125
63
163
126
370
315
55
63

126
61
65 Ohms inserted.

Mar. 3, 1881.
52 U – 6
1/18/81 – #5.

24 e 57.33 v

6279
3000
200 / 9279 R
46 79/200

46
130
1380
46
57 / 5980 / 104
57
280
238
42
52

105
46
59 Chins inserted.

Mar. 3 1881.
56½ U – 13

~~24 e 62.77 v 6279 R~~

24 e 62.77 v

6279
5300
200 / 11579 R
57 179/200

58
130
1740
58
63 / 7540 / 119
63
124
63
610
567
43
63

120
58
62 Chins inserted.

Mar. 3 1881.
54½ V – 13

24C 60.07 V 6279 R
3900
200 / 10179
50 179/200

51
130
1530
51
60 / 6630 / 110
60
63
60
30
60

111
51
60 Ohms inserted.

Mar. 3 1881.
50½ V – 14
1/18/18 #5

24C 56.72 V 6279 R
3900
200 / 10179
50 179/200

51
130
1530
51
59 / 6630 / 112
59
73
59
140
118
22
59

51
61 Ohms inserted.

Mar. 3. 1881.
55V – 14

24C. 62.77V 6279 4900 R

200 / 11179
55 179/200

56
130
1680
56
63 / 728 0/115
63
98
63
350
315
35
63

116
56
60 Ohms inserted.

Mar. 3. 1881.
~~48~~ 52V – 14

24C 57.33V 6279 4750 R

200 / 10979
54 179/200

55
130
1650
55
57 / 7150 / 125
57
145
114
310
285
25
57

55
70 Ohms inserted.

Mar. 3, 1881.
58½ V–14

24C 68.17 V 6279
7700
200 | 13979
69 179/200

70
130
2100
70
68 | 9100 | 133
68
230
204
260
204
56
68

134
70
64 Ohms inserted.

Mar. 3, 1881.
50½ V–15
1/18/81–#5

24C 57.38 V 6279
3250 R
200 | 9529
47 129/200

48
130
1440
48
57 | 6240 | 109
57
540
513
27
57

48
61 Ohms inserted.

Mar. 3 1881.
58½ V – 15
(20) 1/20/81 – #12

24c 70.87 V 6279
8050
200 / 14329
71 129/200

72
130
2160
72
71 / 9360 / 131
71
226
213
130
71
59

132
72
50 Ohms inserted

Mar. 3 1881.
50 V – 15 – #10
1/19/81 (20)

24c 59.40 V 6279
4750
200 / 10979
54 170/200

55
130
1650
55
59 / 7150 / 121
59
55
125
118
70
59
11
59

66 Ohms inserted.

Mar. 3 1881.
54V-16-1/18/81.
#5

24C 62.77V 6279 R
4700
200 / 10979
54 179/200

55
130
1650
55
63 / 7150 / 113
63 55
85 58 Ohms inserted.
63
220
189
31
63

Mar. 3 1881.
52V-18-1/18/81.
#5

24C 57.33V 6279
3200
200 / 9479
47 79/200

48
130
1440
48
57 / 6240 / 109
57 48
540 61 Ohms inserted.
513
27
57

Mar. 3, 1881.
63 U – 23 – 1/20/81
#12 (20)

24 C 70.87 V 6279
9500 R

200 / 15779
78 170
200

79
130
2370
79

71 / 18270 / 144
71 79
317 65 Ohms inserted.
284
330
284
46
71

Mar. 3 1881.
52 U – 26 – 1/18/81
#5

24 C 59.40 V 6279
3300 R

200 / 9579
47 179
200

48
130
1440
48

59 / 6240 / 105
59 106
340 48
295 58 Ohms inserted.
45
59

Mar. 3, 1881.
52 V-28

24 C 64113 V

50000
6279 P

200 / 11279
56 79/200

56
130
1680
56
64 / 7280 / 113
64
88
64
240
192
48
64

114
57
57 Ohms inserted.

Mar. 3, 1881.
55½ V-28-(20)
#12-1/20/81.

24 C 63144 V

6279
7200 R

200 / 13479
67 79/200

67
130
2010
67
63 / 8710 / 138
63
67
241
189
520
504
16
63

71 Ohms inserted.

Mar. 3 1881.
106V-13-Order 39
R208

48 C 114.75

18840
2000 R

200 / 20840
104 40/200

104
130
3120
104
115 / 13520 / 117
115
202
115
870
805
65
115

118
104
14 Ohms inserted.

Mar. 3, 1881.
Order 39-R245
105V-17

48 C 124.20V

18840
3200 R

200 / 22040
110 40/200

110
130
3300
110
124 / 14300
115 40/124

115
110
5 Ohms inserted.

Mar. 3, 1881.
Order 39 – R245
106½ V – 16

4 × C 121.50 V

3200
18540 R

200 / 22040
110 40
200

110
130
3300
110
122 / 14300 / 117
122 110
210
122
880
854
26
122

7 Ohms inserted.

Mar. 3, 1881.
Order 39 – R245
107½ V – 23

4 × C 118.125 V

12540
5700

200 / 23840
119 40
200

118
130
3570
119
118 / 15470 / 131
118 119
367 12
354
130
118
12
118

12 Ohms inserted.

Mar. 3, 1881.
Order 39-R 245
102/2 U-11

48C 118,80V 18840R
2200R

200 / 21040
105 40/200

105
130
3150
105
119 / 13650 / 114
119
175
119
560
476
84
119

115
105
10 Ohms inserted.

Mar. 3 1881.
Order 39-R 240
106 U-22

48C 121,15V
18840
4000R

200 / 22840
114 40/200

114
130
3420
114
122 / 14820 / 121
122
262
244
180
122
58
122

114
7 Ohms inserted.

Mar. 3, 1881.
Order 39 – R 240
108½ V – 9 A

48 C 12420 V

18840
5300

200 / 24140
120 140
200

121
130
3630
121
124 / 15730 / 126
124
333
248
8.50
744
106
124

127
121
6 Ohms inserted.

Mar. 3, 1881.
Order 39 – R 275
115½ V 9 B.

130 V 33 C

18840
9900

200 / 28540
142 140
200

143
130
4290
143
130 / 18590 / 143
130
559
520
390
390

Mar. 3, 1881.
Order 39 — R 230
102½ V — 18

4rC 18840 R ~~12 V~~
30000
218 40

114.0 / V

200 / 21840
109 40
200

109
130
3270
109

114 / 14170 / 124
114 109
277
228
490
456
34
114

15 Ohms inserted.

Mar. 3, 1881.
Order 39 — R 245
110½ V — 10

4rC 126.22

18840 R
4000

200 / 22840
114 40/200

114
130
34420
114

126 / 14820 / 117
126
222
126
960
882
78
126

118
114
4 Ohms inserted.

Mar. 3, 1881.
Order 39 – R256
107/2 V = 3

48 C 123,152 V

18840
4900 R

200 / 23740
118 140/200

119
130
3570
119
124 / 15470 / 124
124
307
248
590
496
94
124

125
119
6 Ohms inserted

Mar. 3, 1881.
Order 39 – R195
~~High~~ – 20

32 C 130 V

15840
3000 R

200 / 21840
109 40/200

109
130
3270
109
130 / 14170 / 109
130
1170
1170

Mar. 3 1881.
Order 39-R205
102V-19

48C 120.15V

18840
1500 R

200 / 20640
103 40/200

103
130
3090
103
120 / 13390 / 111
120
139
120
190
120
70
120

112
103
9 Ohms inserted.

Mar. 3 1881.
Order 39-R245
102½V-23

48C 114.75V

18840
1500

200 / 22940
114 140/200

115
130
3450
115
115 / 14950 / 130
115
345
345
0

15 Ohms inserted.

Mar. 3, 1881.
Order 39—R 225
105 V—8

48C 118.12

81 8 40
4 5 0 0 R

200 / 22 9 4 0
114 140/200

115
130
3450
115
118 / 14950 / 126
118
315
236
790
708
82
118

127
115
12 Ohms inserted.

Mar. 3, 1881.
Order 39—R 210
99½ V—17

48C 113.40 V

18 8 40
2 0 0 0 R

200 / 20 8 4 0
1 0 4 40/200

104
130
3120
104
113 / 13520 / 119
113
222
113
1090
1017
73
113

120
104
16 Ohms inserted.

Mar. 3, 1881.
Order 39-R255
107½ U-6

48 C 124205

18840

24500 R

200 / 2 3 3 4 0
116 140/200

117
130
3510
117
124 / 15210 / 122
124
281
248
330
248
82
124

123
117
6 Ohms inserted.

Mar. 3, 1881.
Order 39-R235
119 U-25

48 C 126120

18840

24500 R

200 / 2 3 3 4 0
116 140/200

117
130
3510
117
128 / 15210 / 118
128
241
128
1130
1024
106
128

119
117
2 Ohms inserted.

Mar. 3, 1881.
Order 39 – R225
108½ U – 21

480 124120 C

18840

4000 R

200 | 22840
114 40
200

114
130
3420
114

124 | 14820 | 119
124
242
124
1180
1116
64
124

120
114
6 Chains inserts.

Mar. 4, 1881.
55 U – 11

10 C – 46½ U

Mar. 4 1881.
54½ U-8

10 C — 48 U

Mar. 4 1881.
55½ U-8

10 C — 48.6

Mar. 4, 1881.
54U-9

10 C—45.9

Mar. 4, 1881.
55U-10

10C—47.9

Mar. 4, 1881.
55—6

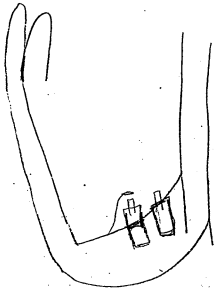
10C—47.9

Mar. 4, 1881.
55U—2

10C—50

Mar. 4, 1881.
55U-12

10C — 48.6



Mar. 4, 1881.
55U-7

10C — 58

Mar. 4, 1881.
550-14

10-C-58

Mar. 8, 1881.
Order 221-#1

42.525 24C

200 4700

41.25 r 48C

4550

200 | 9275

46 75/200

46
130
1380
46
43 | 5980 | 139
43 46
168
129
390
387
3
43

93 Ohms inserted.

Mar. 8, 1881.
Order 221 - #2

130.9 v

Vacuum N. Y.

Mar. 8, 1881.
Order 221 - #3

64.13 v 48 C

6279
3200
200 | 9479
47 79/200

47
130
1410
47
64 | 6110 | 95
576 47
350
320
30
64

48 Ohms inserted.

Mar. 8, 1881.
Order 221 - #4

47.25 V 48 C

200 / 4800
24
130
720
24

47 / 3126 / 66
282 24
300 42 Ohms inserted.
282
18
47

Mar. 8, 1881.
Order 221 - #5

108 V n. 9 Vne
48 C

18840
5000

200 / 23840
119 40
130 200
3570
119

108 / 15470 / 143
108 119
467 24 Ohms inserted.
432
350
324
26
108

Mar. 8, 1881.
Order 221-#6

43205 48C

200 / 4100 R
20 100
200

21
130
630

21
43 / 2730 / 63
258 21
150 42 Chines inserted.
129
21
43

Mar. 8 1881.
Order 221-#7

47125 48C

200 / 5800 R

29
130
870

29
47 / 3770 / 80
376 29
10 51 Chines inserted.
47

Mar. 8, 1881.
Order 221—#8

31.05 VC #8C

200 / 2400 R

12
130
360
12

31 / 1560 / 50
155 / 12
10
31

38 Chains inverted.

Mar. 8, 1881.
Order 221—#9

5872V 48C

200 / 1800 R

34
130
1020
34

59 / 4420 / 74
413
296
236
54
59

75
34
41 Chains inverted.

Mar. 8, 1881.
Order 221 – #10

50.62 V 48 Ω

200 / 5200 Ω

31
130
930
31

51 / 4030 / 79
357
460
459
1
51

31
48 Ohms inverted.

Mar. 8, 1881.
Order 221 – #11

56.70 V 48 Ω

200 / 7700 Ω

38 100/200

39
130
1170
39

57 / 5070 / 88
456
510
456
54
57

89
39
50 Ohms inverted.

Mar. 8, 1881.
Order 221 – #12

54 V 48 C

200 / 6000 R

30
130
54 / 3900 / 72
378 / 30
120
108
12
54

42 Ohms inserted.

Mar. 8, 1881.
Order 221 – #13

72.23 V 48 C

200 / 9600 R

48
130
1440
48
72 / 6240 / 86
576 / 87
480 / 48
432
48
72

39 Ohms inserted.

Mar. 8, 1881.
Order 221 — #14

35.77 V 48 C

200 / 2700
13 100/200

14
130
420
14
36 / 1820 / 50
180
20
36

51
14
37 Ohms inserted.

Mar. 8, 1881.
Order 221 — #15

60.95 V 42 C

200 ~~00~~ / 8500 R
42 100/200

43
130
1290
43
61 / 5590 / 91
549
100
61
39
61

92
43
49 Ohms inserted.

Mar. 8, 1881.
Order 221 – #16

4320 V 48 C

200/6 500 R

18
130
570
19

43/2470/57
215 16
320
301
19
43

38 Ohms inserted.

Mar. 8, 1881.
Order 221 – #17

4995 V 48 C

200/7 300
36 100
200

37
130
1110
37

50/4810/96
450 37
310
300
10
50

59 Ohms inserted.

Mar. 8, 1881.
Order 221-#18

54100 V

200 / 6900 R

34 100/200

35
130
1050
35

54 / 4550 / 84
432 / 35
230 / 49 Ohms inserted.
216
14
54

Mar. 8, 1881.
Order 221-#19

37180 V 450

200 / 2900 R

14 100/200

15
130
450
15

38 / 1950 / 51
190 / .15
50 / 36 Ohms inserted.
38
12
38

Mar. 8, 1881.
Order 221 — #20

61.4275

200/7300 R

36 100/200

37
130
1110
37
61/4810/78
427
540
488
52
61

79
37
42 Ohms inserted.

Mar. 8, 1881.
Order 221 — #21

50.6250489

200/6200 R

31
130
930
31
51/4030/79
357
460
459
1
51

31
48 Ohms inserted.

Mar. 8, 1881.
Order 221 – #22

64.60 V 48 e

200 | 9000 Q

45
130
1350
45

65 | 5850 | 90
585 | 45
0

45 Ohms inserted

Mar. 8, 1881.
Order 221 – #23

60.07 V 48 e

200 | 7400 R

37
160
1110
37

60 | 4810 | 81
480 | 37
10
60

43 Ohms inserted.

Mar. 8, 1881.
Order 221 — #24

50 ohm 48C

200/6400 = P

32
130
960
32
51/4160/81
408 /32
80
51
29
51

49 Ohms inserted.

Mar. 8, 1881.
Order 221 — #25

50 ohm

200/6100

30 100
200

31
130
930
31
51/4030/79
357 /31
460
459
1
51

48 Ohms inserted.

Mar. 8, 1881.
Order 221 — #26

[illegible] 40

200 / 6400 p

32
130
960

53 / 4160 / 78
32
371
450
424
26
53

46 Ohms inserted

Mar. 8, 1881.
Order 221 — #27

45 [illegible] 40

200 / 4500 p

22 100
200

23
130
690
23
45 / 2990 / 66
270
23
290
270
20
45

43 Ohms inserted.

Mar. 8, 1881.
Order 221 — #28

50.2

200/5300 Q

27 100/200

28
130
840

28
51/3640/71
357 28
70 43 Ohms inserted.
51
19
51

Mar. 8, 1881.
Order 221 — #29

33.75

200/2700 Q

13 100/200

14
130
420

14
34/1820/53
170
120 54
102 14
18 40 Ohms inserted.
34

Mar. 8, 1881.
Order 221 — #30

45.22 V 48°

200/2700

13 100/200

14
130
420
14

45/1820/40
180 14
20 26 Ohms inserted.
45

Mar. 8, 1881.
Order 221 — #31

70.87 V 48°

200/10379

51 179/200

52
130
1560
52

71/6760/95
639 52
370 43 Ohms inserted.
355
15
71

Mar. 8, 1881.
Order 221-32

59,4 V 4e

200 | 9200 R

46
130
1380
46
59 | 5980 | 101
59 46
80 55 Ohms inserted.
59
21
59

Mar. 8 1881.
Order 221-#33

54,00 V 4e

200 | 7100 R
35 100/200

36
130
1080
36
54 | 4680 | 86
432 87
360 36
324 51 Ohms inserted.
36
54

Mar. 8, 1881.
Order 221 — #34

38.38.48

200/3000

16 100/200

17
130
510
17
38/2210/58
190 17
310
304
6
38

41 Ohms inserted.

Mar. 8, 1881.
Order 221 — #35

38.38.48

200/3700

18 100/200

19
130
570
19
38/2470/65
228 19
190
190

46 Ohms inserted.

Mar. 8. 1881.
Order 221 – #36

51.97 ✓ 54 ✓

200 / 6100 R

30 100/200

31
130
930
31
52 / 4030 / 77
364
390
364
26
52

78
81
47 Ohms inserted.

Mar. 11. 1881.
No. 1 – Regular

114.75 ✓ 60 ✓

200 / 18540 R

99 40/200

99
130
2970
99
115 / 12870 / 111
115
137
115
220
115
105
115

112
99
13 Ohms inserted.

Mar. 11, 1881.
No. 2 – Regular.

114.75 V 48 Ω

1145 Ω R

13

200 / 2 0 1 4 0

100 140/200

101
130
3030
101
115 / 1313 0 / 114
115 101
163 13 Ohms inserted.
115
480
460
20
115

Mar. 11, 1881.
No. 3 – Regular.

123.52 V 48 Ω

1884 Ω

23

200 / 2 1 1 4 0

105 140/200

106
130
3180
106
124 / 1378 0 / 111
124 106
138 5 Ohms inserted.
124
140
124
16
124

Mar. 11, 1881.
No. 4 — Regular.

114.75 48c

18540
11000

200/19840
99 40/200

99
130
2970
99
115/12870/115
115
137
115
220
115
105
115

112
99
13 Ohms inserted.

Mar. 11, 1881.
No. 5 — Regular.

116.5 48c

18540
1800

200/20640
103 40/200

103
130
3090
103
116/13390/115
116
179
116
630
580
50
116

12 Ohms inserted.

Mar. 11, 1881.
No. 6 — Regular.

116 10 V 45 C

1884 U

2300

200 / 21140

105 140/200

106
130
3180
106
116 / 13780 / 118
116
218
116
1020
928
92
116

119
106
13 Ohms inserted too.

Mar. 11, 1881.
No. 7 — Regular.

130 V 20 C

2512 7

6000

200 / 31127

155 127/200

156
130
4680
156
130 / 20280 / 156
130
728
650
780
780

Mar. 11, 1881.
No. 8 — Regular.

130V 48C

18840

500

200 / 19340

96 140/200

97

130

2910

97

130 / 12610 / 97

1170

910

910

Mar. 11, 1881.
No. 9 — Regular.

118.12V 48C

18840

100

200 / 19840

99 40/200

99

130

2970

99

118 / 12870 / 109

118

1070

1062

8

118

99

10 Ohms inserted.

Mar. 11, 1881.
No. 10 – Regular.

120.82 V 48 e

1884 0

4000 Ω

200 / 2 2 8 4 0

11 4 40/200

114
130
3420
114

121 / 1 4 8 2 0 / 12.2
121
272
242
300
242
58
121

114

8 Ohms inserted.

Mar. 11, 1881.
No. 11 – Regular.

124.5 V 48

1884 0

430 Ω

200 / 2 3 1 4 0

1 1 5 140/200

116
130
3480
116

124 / 1 5 8 8 0 / 121
124
268
248
200
124
76
124

122
116

6 Ohms inserted.

Mar. 11, 1881.
No: 12 – Regular.

113.4 V 48 C

18840
8200 P

200 / 22040
110 40/200

110
130
3300
110
113 / 14300 / 126
113
300 127
226 110
740 17 Ohms inserted.
678
62
113

Mar. 11, 1881.
No. 13 – Regular.

113.4 V 48 C

18840
6000

200 / 24840
124 40/200

124
130
3720
124
113 / 16120 / 142
113
482 143
452 124
380 19 Ohms inserted.
226
74
113

Mar. 11, 1881.
No. 14 – Regular.

122.17 v 48e

18540
2600 R

200 / 21440
107 40/200

107
130
3210
107
122 / 13910 / 114
122 107
171
122
490
488
2
122

7 Ohms inserted.

Mar. 11, 1881.
No. 15 – Regular.

113.40 v 48e

18540
1200 R

200 / 20040
100 40/200

100
130
113 / 13000 / 115
113 100
170
113
570
565
5
113

15 Ohms inserted.

Mar. 11, 1881.
No. 16—Regular.

118/12 V 48 C

3400

11840 R

200 / 22240
111 40/200

111
130
3330
111
118 / 14430 / 122
118 111
263
236
270
236
34
118

11 Ohms inserted.

Menlo Park Notebook #245 [N-81-03-15]

This notebook covers the period March 1881. The entries are by Charles L. Clarke and consist of notes, calculations, and drawings relating to experiments with Porter-Allen and Buckeye dynamos. The label on the front cover is stamped "Charles L. Clarke." The book contains 280 numbered pages.

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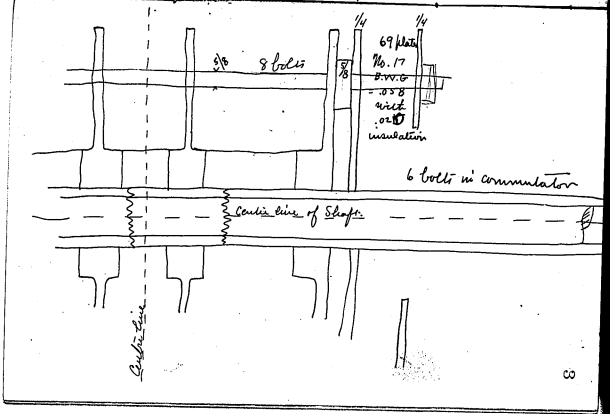
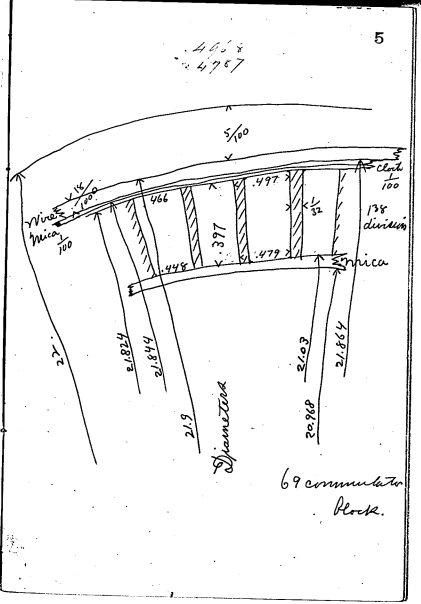
XE-172 N-81-03-15

Buckeye Dynamo.
450
Revolutions.

See Book 116
pages 116 to 139 and 209

B


1/4
1/4
69 plate
No. 17
B.W.G
.058
with
.020
insulation
5/8
8 bolts
5/8
6 bolts in commutator
Centre line of Shaft
Centre line


4787
5/100
Cloth 1/100
14/100
Vulcanized mica 1/100
.466
.497
.397
.479
.448
1/32
138 division
mica
27
21.824
21.844
21.9
Diameter
21.903
21.864
20.968
69 commutator Block.

4 5/16 3 7/8"

March 15 & 16 1881

Curve of Magnetism

Clarke.

These experiments were conducted on the direct-acting Porter-Allen dynamo to find the curve of magnetism.

Available length of field

Diam. of field

Diam. of iron core of armature.

Experiments made with external circuit of high resistance Thompson mirror – galvanometer.

Descending field curve.
Field weakening.
20 Daniels cells = 32°.

Magnet	Armature	Revs.	at 1000 revs
173	70	216	324
167	70½	216	326.4
50	60	224	267.9
40	56	232	241.4
28	45	242	186
20	40	226	177

Ascending Curve.
Field strengthening.

Magnet	Amp.	Revs.	Amp. at 1000 revs.
Open	40	247	161.9
39	50	236	211.9
65	60	228	263.2
120	70	214	327.1
176	75	219	342.5
177	76	214	355.1

76 the limit of magnetization was attained.

Field the broken

Ascending curve.

Field strengthening.

Magnet-	Amp.	Rev.	Ampm. at 1000 revs.
Open	40	252	158.7
30	45	241	186.7
39	50	244	245.9
50	55	240	229.2
60	60	230	250.9
50	66	265	249.1
112	70	246	324.1

The speed of engine was gradually increased but no change was produced on magnet circuit.

Armature deflection was taken with engine at 628/revo. deflection 215° with 112 in magnet.

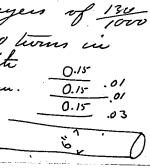
Resistance of magnets (6 cores) = 23 ohms.

Comparison of the medium magnet with Pratt-Allen dynamo magnet.

By experiment of Dec 10, 1860. the deflection of 21.8 = 14.7 volts gave a current of 10 webers, the resistance of the magnet being 1.47 ohms.

The corresponding deflection for armature was 144° = 97.2 volts at 965 revo. or 100.7 volts at 1000 revo.

There are 3 layers of $\frac{13u}{1000}$ wire with 230 turns in each layer with an average diam. of 6.5 inches.



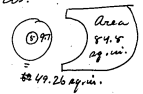
The total number of turns is 1380.

The cores are 3 feet long and 6 inches in diam.

The weight of the fields, cast together is 408.8 lbs. = 1569.8 cu. in. 480 lb. per cu. ft.

The iron of the armature, wrought iron plates at 480 lbs. per cu. ft. 455.66 cu. in. = 126.6 lbs.

Total is 535.4 lb.



The no. of commutator blocks is 75 and 2 turns in each coil. The effective length is therefore $75 \times 2 \times 9\frac{1}{4}''$
$= 115.625$ feet

~~For one foot therefore~~

At 1000 revs. and armature diam. of 9.7" the surface speed is 2539.46 feet per m. and volts = 100.7.

At 1000 feet per m. the volts = 39.26

and for 1 ft. of cutting wire = .339546 volts.

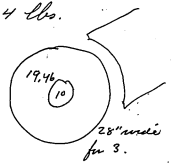
The free magnetism depends upon sq. root of diam. = $\sqrt{6}$

also sq. root of length = $\sqrt{36}$

also inversely as the separation of armature from dynamo field. = $\frac{1}{(.225)^2}$

$$\therefore 5.34 \times \sqrt{6} \times \sqrt{36} \times \frac{1}{(.225)^2} \times 1380 \times 10 \times \text{Constant} = .339546$$

1/3 of
The Potts-Allen dynamo
weight of fields
744 lbs.



For $\frac{1}{3}$ the length the contents is 2043 cu. in. and being made of ~~cast~~ wrought iron plates

Weight = $\frac{2043 \times 480}{1728}$ = 556 lbs.

The length of cores is 3 ft 6 $\frac{1}{2}$"
and diam. 7 $\frac{1}{2}$".

There are 6 layers of No. 12 B.W.G. and 310 turns in each layer. a total for 2 cores of 3720 turns.

There are 69 commutator bars and armature wound with single turn and 28" long.

Effective length

$69 \times 28'' = 161$ feet

and $\frac{1}{3}$ of this for $\frac{1}{3}$ part

$= 53.7$ feet.

~~If I A~~ C = current

At 1000 revs. per m.

the cutting speed will be $\frac{3.1416 \times 19''.46 \times 1000}{12}$

$= 5095$ feet per m.

If the proportions are true the following should hold

$$(744 + 556)\sqrt{2.5}\ \sqrt{42.5} \times \frac{1}{(.52)^2}$$

$$\times 3720 \times C \times \text{constant}$$

$$= .339546 \times \frac{1}{5.095 \times 53.7}$$

The medium machine is wound with ~~with~~ three layers - from page 20 we have the length is

$(6. + .15 + .15 + .15 + .01 + .01 + .03)\, 3.1416 \times 1380 \div 12$

$\doteq 2348.346$ feet

and resis

$$\frac{10.64 \times 2348.346}{750^2} = 1.48 \text{ ohms.}$$

Length of cutting wire

$$\frac{75 \times 2 \times 9.25}{12} = 115.625 \text{ feet}$$

To reduce the diagram of deflections on armature Dec. 10. 1880 to volts per foot of wire at 1000 feet per min multiply the degrees by

$$\frac{.671}{115.625 \times 2.45 \cdot 06} = .0023822$$

For each degree on magnet multiply by

$$\frac{.675 \times 1380}{1.48} = 629.4$$

Menlo Park Notebook #249 [N-82-03-12]

This notebook covers the period February 1882-April 1883. All of the entries are by Charles T. Hughes. Some of the entries were witnessed by C. Van Cleve. The book contains extensive notes relating to electric railroad experiments. There are also a few drawings. The label on the front cover is marked "Electric Railroad Hughes." The book contains 130 numbered pages. Numerous pages at the end of the book have been torn out.

Blank pages not filmed: 122-130.

Sunday Feb 17th 1882

Tried Motor as it came from Forrest St Works with fast pulley on Countershaft from Armature. Result not satisfactory. Unless belts were very loose the power was not great enough to start Motor and car without difficulty. Armature in use "A" .14 ohm. Two seperate coils round the magnets one of 1.7 ohms resistance and the other 10 ohms both in multiple arc. The large coil

to be used for starting and the 10. ohm coil after getting under way and the large coil cut out entirely. Worked fairly but took too much power and heated the magnets, and made 3 dynamos in multiple are heat up very much. Heated armature so as to melt the solder.

Monday Feb 13 1882.

Burned an "A" armature from partial cross developed the Sunday before.

Chas. T. Hughes
W. Wasin Pierce

Wednesday Feb 15th 1882

Took off Armature Comm-
-utator Pulley and substit-
-uted a Hewson Clutch
same diameter 22"

Friday Feb 17th 1882

Put a "B" Armature of
.035 ohm resistance C.C.
into Motor. and could
not start it while
using the 10 ohm coil
around Field Magnet.
Used the large Coil
of 1.7 ohms and started
at high rate of speed
but found that we
lacked power to start
heavily loaded car

Sunday Feb 19 1882

Put in a .14 ohm armature using large coil around field Magnet 1.7 ohms. After making three trips of about a mile and return burned out the Armature owing to the fact that a temporary canvas covering over the Armature concealed the fact that the armature was hot until it blazed burned switch connections in Cab. Tested them together and found B. Armature in result same as before. Evidently "B" not the thing.

Friday Feb 26 1882

"A". Armature with 100 ohm coil around magnet visited by J. C. Henderson, Judge Kelly, Mr Mogg, and Mr Kelly, when made six trips about one mile and return with Motor and Passenger Car. Ran about 30 miles an hour in places found Armature quite warm. Evidently power marked at the Motor could only pick about Car containing 20 people and took quite a distance to get up full speed while going up a grade 25 feet to the mile

Wednesday Oct. 12th 1882

Put in a .56 of an ohm Armature. Works very strong and takes but little current as no spark worth mentioning could be noticed at switch when breaking. and Man in charge of Dynamos could not tell when we were running from the spark on Commutator Motor started car filled full at a mile distant from Dynamos without any trouble. After making two trips found Armature

Jack yard. but nothing like so warm as a .14 Armature after doing the same distance. .56 Armature geared to required speed seems to be the proper thing.

Saturday March 11th 1882

Visited by Russell with party including Mrs Goddard and they were delighted. Dynamo's making 1700 revolutions per minute .56 Armature in Motor makes 580 while standing still or a little less than 70 miles per hour.

Visited by Mr Ladd and Mr. Steinman. Took them to Dark Lane with the .12 Armature which was quite hot before they came from being used to haul dirt car. Took back in fine shape and Armature cracked and burned out. Found that while Armature made 1050 Revolutions after the latter it only made 1000 at most end of Trestle. Bad connection somewhere. Armature

at Bank Lane made
920 Revolutions, while
doing no work.
March 11th, 1882

Put in .56 Armature.
Found that at the Cable
it made 560. and at
the Treasury it was only
540. Found the reason
for it in bad connections
and after lightening the
bolts at the joints
Armature made same
number of revolutions
at Treasury as at Cable.
C. D. Van Cleve Chas. T. Hughes

Mch 13th 1882 19

Revolutions of .56 Arm-
ature at Cable junc-
tion 478. at Dark
Lane, 444. after tight-
ening all the bolts
Cause of drop bad
contact with rail
and tread of wheel
filed place bright
on track. and gain
460. Rev at Dark
Lane.

Chas. T. Hughes

Asst Nav Clerk

March 14th 1882.

Measured the Mach. as far as laid short circuiting one end and found the resistance less than one ohm and uniform for about 7½ miles of rail.

March 19th 1882

Found no short circuits in Turn Table and afterward in Motor also had cauch. ach in Armature switch Wire. Both sides shanted or insulated. Chas T Hughes
Urban Blake

Mch 18th 1882. 23

Had 35. people on car and Motor. and took them to Joe's cut and back. in good shape 56 Armature just round.

Chas. F. Hughes

O. B. Van Pelt

Apl 1st 1882

Find 2.74 ohm Arti-
-ature found bad
cross. and dilute-nit.
very far this seemed
to do the most easily.

Chas. F. Hughes

Albany Plane

Apl 6 1888 27

Found base cross in
14 Armature caused
by defective insulat-
ion between commutator
bars and end cap, an
arc jumping across here.

Put in barrier mica and
cut cap down below
commutator and which
running all night.

Chas. T. Hughes
Orban Place

Apl 10 1882

Run .56 with Dynamos in series, Magnets of Motor in series didn't do very well. Field heat with load on Heated Armature. Put such magnets across tracks separate and found it much improved.

Chas. T. Hughes.

B A Bar Plane

Apl 12th

worked all day hauling Fies and gravel Armature not shaking

Apl 13th 1882

Same thing. Machines in shape but quite warm.

Apl 14th

used 1H Armature with 10. ohm fields plenty of speed but not much power. with load on magnets very weak. Put resistance in Armature circuit found it much better

Chas S Hughes
C H Van Ellen

Apl 15 1882

.56 Armature 10 ohm
Field Dynamos in series
worked well but Mach-
ines got quite warm.

Apl 17 1882

Put in 1,2 ohm Armature
found cross in commu-
tator caused by
brass wire band connec-
ting the bars in three
different places. Cur-
rents scorched by sold-
ering iron as crosses
were at that places
took out scraped and
put together and runs
all right. Charles Hughes
W. O'Brian Clark

Burned out armature of one of the dynamos in a single coil. Logan found the iron at that point bare and above the fibre 1/16 of an inch thick. Fibre should be above the iron and heavily insulated on the corners, especially, seems to be harder on machines in series, than on two machines in multiple arc.

Chas. T. Hughes

O. A. Ban Stone

Apl 19th 1882

Put in .1H Armature but it is not the thing as the Armature takes all the current when the load is put on and field very weak.

Apl 20th, 1882

Used .56 Armature all morning to haul gravel does well but the drop at far end very slim - with two machines in series. Much greater tension with three in multiple arc. Chas. T. Hughes
Albert Clow

Apl 21st 1882

Hauled gravel all A.M. with two machines in series and .56 Armature in Motor. Machines got hot. In P.M. run with three machines in Multiple arc. did well all but drop at far end.

Apl 22nd 1882

Run .56 until 2 P.M. worked very well getting a little warm.

Apl 23d 1882

Run with 1.7 ohm
Armature. 10 ohm field
worked very strong
and deduct heat at
all, with Machines in
series one pair. Found
that the brushes on
one Dynamo melted
as fast as they could
be put on. Dynamos
heated very much.
P.M. Run with 1.7 Arm-
ature 3 Dynamos in Mul
-tiple arc. at darkness
the drop was so great
that we just moved
Motor while doing nothing

made 486 revolutions while at Cable it made 376. Drop gradual but in two or three places was evidently due to bad joints.

Put two machines in series Drop not so plain armature got quite hot with far of Passengers.

Chas T. Hughes

M. H. Van Blom

Tried connecting the field of freight Locomotives in different ways. The two top cores in series and the in multiple are and the lower one in seperate multiple are. Found that the lower Magnet was much the stronger. Armature got hot while hauling load of ten tons.

Chas. T. Hughes

St Albans Clove

Nov 11th 1882.

The brushes sparked badly with two top coils in series and the strength of field decreased very much when armature is put into circuit.

Found it the same when the whole three coils were in series. Hardly any difference in strength of field.

Chas. F. Hughes

E. A. Van Clève

Nov 11th 1882.

Hauled six cars loaded with five tons each. Cars themselves weighing 1559 lbs each from where they were loaded 2400 ft from cable.

Armature got quite hot.

Hauled two cars with Passenger engine from same place. Armature just warm.

Chas. T. Hughes

C. H. Van Pluve

Nov 13th 1887

Indicated the engine with Freight Locomotive running. Hauling four loaded Freight Cars Had to stop just west of Dark Lake. Armature quite warm.

Field magnets also very warm.

Engine ran very slow going up grades.

Chas. T. Hughes

A. A. Van Cleve

Nov 14th 1882.

Indicated Engine and
Machines Light
Then with Track on
Then with Field of Freight
Locomotive in
Then with Field and
Armature both in all
on same card. Damp
day and cards varied
badly.

Chas. T. Hughes

A. A. Van Cleve

Nov 17th 1882

Indicated Engine with Passenger Engine and Car and show people running 30 miles per hour. Cards showed serious loss of Power in Tract. Both Every thing Kept cool. Concluded that the Indicator diagrams could not be relied upon.

Chas. T. Hughes

C. A. Van Blare

Nov 18th 1882.

Indicated Engine with Freight Engine running hauling 3 loaded Cars Equal to 18 Tons.

Diagram showed 72. Horse Power in Bring used. 40 of which was in the Motor. Something Evidently wrong.

Chas. F. Hughes

C. H. Van Cleve

Nov 19th 1882

Took indicator Card first with Truck and Motor fields in and then over same. Card with Armature in and found that the Armature was taking 17.65 H.P. when it should take but 7 or at most 3. Connected two top Coils in series and then in multiple arc with power one in multiple arc. Enquire took load much easier and better than before

Charles J. Hogan

O. H. Barnes witness

Nov 21st, 1882.

While hauling 3 loaded Cars that the magnet wires got very hot and finally began to smoke. Stopped and hauled freight Engine into house with Passenger and burned Passenger Engine armature. Found on examination that only upper layer was injured caused between the brass binding band and wire where soldered. The band was burnted off.

C. Albanese Clerk Chas. T. Hughes

Nov 21st 1882.

Put new Armature in passenger Engine and took Mr Taylor & Wife over the road in fine shape.

Afterwards found the cross in freight Engine magnets and repaired it, with two top cross in series hauled three cars loaded with Ears. Noticed a cross in the magnet here and found where a wire was against the base of magnet.

Chas T. Hughes

C & A Bar Clerk

Nov 22nd 1882.

In readjusting the Clutch on Freight Engine No Logan & Mr Faulkner noticed a screw out of place, and found that the lower coil was not in circuit at all and the Engine was doing as good work without as it had coordane with it.

Chas F. Hughes

O H Bamblebee

Nov 23rd 1882

Found magnet wire flower coil badly burned. cut it out entirely and used the two upper coils

Freight Motor drew 3 loaded cars over the road without heating any more than without it.

Chas. F. Hughes
G. H. Van Clees

Nov 24 1887

Ran both Engines together over the road. Noticed quite a drop in speed of both Engines when starting but soon recovered the speed of it. Indicator diagrams showed large amount of power used while running both Engines.

Chas. T. Hughes

W. H. Bean Oshkosh

Nov 28th 1882. 71

Started running with Passenger Engine at 9 A.M. taking account of the condition of the fire in furnace. Made five round trips to Pumphouse and back. equal to 20 Miles Armature getting warm. took the Freight Engine with two loaded cars, (Cars with load weighing 12 tons) to Pumphouse and back. equal to four miles, thus running until 11 30 A.M. Fire in better condition than when we began running. Used H. 16 lbs of Anthracite Coal. Took out the flag breaking the crown excepting the field of the four Dynamo Machines and at 1 20 P.M with the

fire in the same condition
as when we began found
that in the last 24 hours
with the friction of Engine
and Machines and the
fields of the Cour by name
has we had burned 2
716 lbs of the same kind
of coal. The main belt
by the Engine was very
hard, and we also found
that Engine took steam
before opening its centres.
The track was covered
with snow the first trip

Chas. L. Hughes

Ran the Freight Engine one mile and a Half through snow seven inches deep on the rail and was stopped by the guard wheels of the Clutch (which are very close to the ground) filling and packing with snow. Engineer at the Station noticed that the belt slipped at times which was when the circuit was completed through the Armature of Motor and the wheels were clogged so that nothing could move

Chas. F. Hughes.

Dec 7th 1887.

Put wheels over the gear and clutch to keep snow out and ran the entire length of the road regardless of snow of which there was a bank seven inches. Had Engine left taken up at Station

Chas. F. Hughes

Dec 4th 1882.

Ran the freight Engine light from 1.00 P.M. until 4.00 P.M. making 5 trips equal to 19 miles and day weighed the water evaporated and found that in running those trips and leaving the same amount in boiler as when we started we had used 4281 lbs of water and 477 lbs of Coal

Temperature 30° above zero

Chas. T. Hughes

Ran Freight Engine and
loaded Car weighing 6
Tons. from 1 30 until
4 35 PM. making 4 1/2
Trips equal to 17 miles
weighed water evaporated
and found that in running
three hours and leaving
water in the boiler the
same as when we started
we had used 4786 lbs
and burned 474 "
of Coal.
Temperature 41 above zero

Chas. T. Hughes

Dec 7th, 1882.

Ran Freight Engine light with one machine 55 Jacks E.M.T.

Tried to start the Passenger Engine with one machine but could not move it.

Chas. T. Hughes

Ran Passenger Motor and Car to Pumpkintown with 100 Volts but ran very slowly at distant end. Could only just start back.

Did the same with Freight and didn't notice anything like the amount of drop.

Chas. T. Hughes

Found in four places where both wires along-side of the rail were both broken, which would account for some of the drops. Fixed them and ran Passenger Engine with Engine at Station speeded up to 78 Rev's & Machines in service giving 220 Volts. Ran splendidly

Chas. L. Hughes

Connected all the coils of the freight Magnets in series making the resistance 60 Ohms. Found that the Armature got too much current and field too little. Armature got very hot and could hardly get power enough to get back into the Engine House.

Chas. T. Hughes

Dec 14th 1882.

Tried cutting out the lower core entirely leaving the resistance 40 ohms and found the Engine more much better. Think 40 ohms about right for .56 Armature.

Chas. T. Hughes

Started the new Engine with "K" Machine for Motor with Armature wound with .17 ohm resistance. Motor Armature made about 350 Revolutions with Dynamos making 1120. Engine ran all night but the 18 inch belt which is new had stretched so much that it slipped badly. The strain on the frame was so heavy that the timbers showed signs of weakness and are

had to stop business
and trace them up.
The Dynamos were
giving about 90 volts.
Will have to have higher
E.M.F. to make the
speed desired 15
miles per hour

Chas. T. Hughes

Found that going around curves the 18" truck ran on edge caused by the change in direction of the truck. to remedy which I made the platform and one truck rigid and allowed the other end of platform to slide on the other truck with straps to prevent it going too far while going around curves and springs arranged to throw platform back into place

when both trucks were on straight track
Also ordered a grip link belt from the
Link Belt Machinery
Co of Chicago through
their New York agent
Mr J Howard Smith
81 John St.

The grip
link belt can be run
loose and a belt 4"
wide does the work
of an 18" double belt
track improvement

Chas. T. Hughes
A H Ban Clerk

Feb 29th 1883 101

Visited Greenville to see the Daft Electric RR. on Feb 28th 1883. Found it no differ-ent from what I saw to the Edison with the exception of a trade made by pass-ing a current around magnets with their poles near the peri-phery of the wheels and another arrange-ment of magnets with poles near the track for the purpose

of increasing the weight of machines by the same means.

They use a flat belt running on a sprocket wheel to communicate the power from the motor. Also use friction rollers on armature shaft working on collar on track wheel.

Chas. T. Hughes

To get over difficulty caused by change of position of axle when going around curves causing belt to come off. Bolted truck on which Dynamo is placed to the platform making platform and axle truck rigid. Took centre bolt out of axle truck and allowed platform to slide independent of truck with stops placed at proper distances to

prevent going too far
with springs to help.
It assumes its normal
position when straight
truck is reached and
a rigid arm bolted
to the platform ahead
of center bolt, arm
working so as to allow
the truck to swing in
any direction by
means of a pin running
through the arm and
center of truck but not
through platform
thus keeping truck
in place without
interfering with all

side movement and allowing truck to conform to curves without changing the relative position of the driving axle and countershaft thus keeping belt in position

Chas. T. Hughes

Apl 27 1883

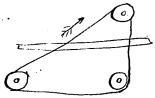
Found the arrangement for keeping belt in position to work perfectly

Chas. T. Hughes

April 4 1883.

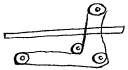
Found that triple belt
belt didn't work well
on account of the
position of countershaft
and driving axles
the upward pull of
belt taking so much of
the weight of driving
wheel off the track
that the machine did
not have weight enough
to give traction to draw
70 tons. Position was
thus

Put in sprocket wheel to change direction of pull thus.



Found it work both ways fairly but when going in direction indicated by arrow lifted wheel off track

Put in another wheel thus.



and got around difficulty

Chas. T. Hughes

Apl 24th 1883.

Found there was not weight enough over driver to prevent wheel slipping. Put 150 lbs over driver and kept it down.

Chas. F. Hughes

Apl 22d, 1883.

Found that we did not get the power that we should on account of resistance being too low in Armature. Put outside resistance in and found it work better.

Chas. T. Hughes

Apl 23 1883.

Found that when the clutch was thrown in that the momentum was so small that the armature speed was very suddenly reduced.

Put fly wheel weight 150 lbs on to crank shaft. Improved efficiency of motor just one 6 the bar. Well!

Heavier wheel would do much better.

Chas. F. Hughes

Menlo Park Notebook [N-80-02-16] (unnumbered)

This notebook covers the period February-March 1880. There is also an entry for July 1880. All of the entries are by Edison and Francis Upton. Included are notes and drawings relating to lamp experiments and to photometric tests of lamps. The book also contains Edison's description of the ideal lamp and Upton's notes on meter and dynamometer tests. There are two labels marked "Photometer" and "Feb 1880." The bottom part of the label containing the Menlo Park notebook number has been torn off. There is an index on the inside front cover. The book contains 284 numbered pages.

Missing page numbers: 279-280.

A — Index.

Analysis of Carbons tested — 1, 35, 79,

" 11, 13, 15, 17, 19, 21, 23, 83, 85, 87, 122, 153, 155, 157, 159, 161, 163, 167, 171, 175, 177, 179, 181, 183, 185, 187, 192, 193, 195, 197, 198, 199, 201, 203, 205, 207, 209, 211, 213, 215, 217, 219, 221, 223, 225, 227, 229, 231, 233, 235, 237, 238, 239, 241, 243, 245, 247, 249, 251, 253, 255, 257, 259, 261, 263, 265, 267, 269, 271, 273, 276, 277, 279, 281.

Circulations — 2, 4, 30, 31, 33, 35, 37

" 38, 39, 40, 41, 42, 43, 44, 47, 48, 49, 50, 52, 53, 54, 55, 56, 60, 62, 64, 72, 108, 110, 132, 134, 136, 137, 138, 139, 142, 150, 152, 154, 155, 160, 162, 163, 166, 169, 170, 174, 176, 178, 179, 186, 188, 190, 192, 194, 196, 200, 202, 206, 208, 210, 214, 216, 226, 228, 230, 234, 236, 271, 272, 274, 275, 282, 283.

Carbons — coated with Plumbago

tube — 139, 141, 143, 145

Carbons, Regular — 25, 27, 29, 43, 44

" 57, 58, 59, 63, 65, 67, 69, 71, 73, 75, 77, 81, 89, 91, 93, 95, 97, 99, 101, 103, 105, 115, 117, 119, 120, 123, 125, 127, 129, 131, 133, 135, 147, 148, 149, 151, 156, 189, 191, 232.

Carbons — Small paper loop, 61, 79, 106.

Feb 4 16 1880

"

Coating a carbon with a paste of zirconia oxide with alcohol. caused the Zr. to melt and contract and put a tension on the carbon which broke it & thinks some of the oxide

small horseshoe used — gave pr

gas jets — The fluorescence w

strongest we have yet seen

A — Index.

Analysis of Carbons to date — 1, 3, 5, 7, 9,
" 11, 13, 15, 17, 19, 21, 23, 83, 85, 87,
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261, 264, 273, 276, 277, 279,

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120 BROADWAY, NEW YORK.

From Library

— Brooklyn N.Y.

May, 189

Commencing 4
" 57, 58, 59, 63, 65, 67, 69, 71, 73, 75,
77, 81, 89, 91, 93, 95, 97, 99, 101, 103,
105, 115, 117, 119, 120, 123, 125, 127,
129, 131, 133, 135, 143, 145, 149,
151, 156, 189, 191, 232.
Carbonic — Small paper loop
61, 79, 106.

A

Feb 4 1880 1

"

Coating a carbon with a paste of zirconia oxides with alcohol. caused the Zr. to melt and contract and put a tension on the carbon which broke it. I think some of the oxide was reduced by the carbon but am not sure - The zirconia was coated with carbon in some places jet black in other places only browned - the lamp was brought to avoid incandescence small horseshoe used - gave probably gas jets - The fluorescence was strongest we have yet seen

$\frac{1}{10000}$ 9°C

$\frac{1}{200}$ $\frac{1}{100}$

280) 10000 (35.6 Ans
840
1600
1408
2000

35.6
2240
14240
716
716
801888.0
100

280
12
560
259
3360

.26) 100 (384
78
220
208
120

380) 801888.0 (
80184
38.4
320736
641472
2405520
30790656

9) 180 (299
180

9/100 (11.1
9
1

30800
308
3360
36) 36188000 (10.
36
2588

being intensely violet, this seems to show that the fluorescence is not entirely due to the molecular impact on the glass; - The appearance of the oxides on examination under the microscope resembled paste which had dried contracted and cracked. where the arc formed there was vitreous fusion

The same size of carbon was coated in the same way with alumina this was immediately reduced by the carbon at high incandescence and destroyed it - this is another

24.7
1.75
1285
1799
247
45.25 | 3456 (775
315
336
315
210

Remainder
value

9.5 17.5

108
210
2100
5040

confirmation of my idea that metallic aluminium may be produced cheaply from the oxide by packing it around ~~exposure~~ long thick sticks of carbon and exhausting the tube and rendering the carbon incandescent by the current from the Faradic machines no fluorescence, as it was destroyed before highest temperature reached

The cause of the formation of a long crack and the subsequent breaking of a chip of the glass by the action of the pressure of the atmosphere is undoubtedly

due to the sudden heating of the platina wires passing through the glass especially when the wires are small and the resistance of the carbon small, with .010 wire and 78 ohm (cold) lamp. slowly putting on current did not cause a crack whereas when the glass was cold the sudden putting on of the current caused the lamp to be instantly destroyed by the formation of a crack which

so weakened the glass that the pressure of the atmosphere was sufficient to break of a piece of the glass and project it into the vacuum -

The same cause is active when an arc springs across between the clamps which if it does not have sufficient power to melt the wire is sufficient to give a sudden accession of heat to the platina wires, and thus cause a sudden expansion cracking the glass.

I have noticed that when lignium vitae clamps, or any clamp made of carbonizable material is used that on reaching high vacua and heating that a gas comes out of the clamp and lowers the vacuum and this will continue for hours, if there is much gas there will appear a bluish halo shooting out from the carbon (one side only) near the clamp. this gradually increases until there suddenly springs a bluish arc between the clamps and if the circuit

is not immediately broken on
appearance of this arc the wires
will be fused, on destroying the
arc no matter how quickly after
its formation the clamps will be
found to be red hot. this in its
turn tends to cause more gas to
flow out of the clamp and reduce
the resistance and augument the
size of the arc = as the arc has
small illuminating power although
between carbon clamps I take
it that it is entirely gaseous

and that it is carbonic oxide or
carbonic acid gas, when this air
is formed I notice ~~that the~~ glass
near the clamps is blackened w/
the same was a the whole of the
globe is by the long continued
action of the lamp. ~~AAAA~~ The platina
leading wires ~~to~~ which the carbon
clamps are secured even when
there has been no perceptible arc
are coated with carbon just
like lamp black. for a space

of 1/4 of an inch, the clamps instead of being shiny are black and in fact the whole fibre has this oily deposit as the great drop shown by the McLeod gauge when the first heating takes place and the long continuance of the drop when the carbon remains heated notwithstanding the action of the sprengil shows that the gas must be in a condensed form and great in quantity and

If it be carbonic oxide, it must have a very pernicious effect. hence I think that the smallest possible carbon clamps should be used if used at all and some means should be used to heat the clamps before the fibre or horseshoe is heated so that the air or gas may be abstracted by the pump before it has a chance to act upon the lamp but the best clamp would undoubtedly be platinum Iridium alloy of

the smallest dimensions —

I have noticed that the glass of nearly every lamp especially those which have shown fluorescence has a mottled appearance, the polish being taken off where the spots are and these spots are more whitish than the rest of the glass. It may be that there is molecular rearrangement or it may be that the carbonic acid has combined with the potash + soda of the glass.

and after all have combined it is decomposed again by impact or it combines and any further Carbonic acid is decomposed but this is a far fetched supposition.

~~[illegible]~~
~~the carbon [illegible] than to the platina~~
~~Clamp [illegible] not that [illegible]~~

Photometric tests

March 7, 1880. TAG

Larger sized Bevevand burner chimney clean

10^h	$45'$	$53''$	410 grains
10^h	$48'$	$15''$	400 grains
10^h	$48'$	$20''$	380 grains

45 53
3 2
150
207 : 210 :: 120 : 121

53.3
26.7) 53.3 (2
53.4

2
2
4
2
8 candles

Good flame

Very large flame nearly smoking

551

249) 551 (2.21
498
530
498
320

2.21
2.21
221
442
442
488841
2
9.76 candles

Tay

Mackenzie's lamp full flame

546

254) 546 (2.14
508
380
254
1260
1016

2.14
2.14
856
214
428
45796
2
9.15 candles

9.15 Candles

Thin side kerosene

49.8

312) 49.8 (.1

312

86

Ans

E. L.

$\frac{260}{3}$ Volts

55.2

248) 55.2 (222

496

560

496

640

222
222
444
444
444
49284
2
9.85

61
61
6

615
3782-25

615
185) 615 (33.1
555
600
555
450

469
3.31

616
184) 616 (33
552
640
552
980

183) 617 (3.3
549
680
549
1310

90 Volts

58.5
.215) 58.5 (272
430
1550
1505
450

272
272
544
2064
544
79984
2
14.99

250
3 Volts

61.2
18.8) 61.2 (3.26
564
480
376
1040

326
326
1956
652
978
106276
2
21.2

62.25

17.75) 62.25 (3.5

~~100~~

53.25

9000

8875

1250

3.5

3.5

175

105

12.25

2

24.4 candles

100 Volts

63

17) 63 (3.7

51

120

119

3.7

3.7

259

111

1369

2

27.3 candles

2~~8~~5 ?

59.75

2025)59.75(295

4050

19250

18205

10450

295

295

1495

2655

590

87045

2

17.4 candles

$\frac{285}{3}$ Volts

60.25

1975)6025(30

5925

1000

18 candles

60.75

1925 / 60.75 (3.15

5775

3000

1925

10750

315

315

1565

315

465

79215

19.8

172 : 1.75 :: 93.5

175

4675

6545

935

172) 16625 (94.5

1548

882

688

94.5

3) 283

94.5

4177) 33000 (8. per H.P.

33388

94.5) 3950000 (4177

3780

1700

945

7550

6615

9350

38

24

12h 33' 28"
12h 44' 45"
45
1217
640
677

1770 grains
1725
45
75
675

16) 4177 (260
32
97
96

260 ft.

4777 ft lbs. 3c

TAG

622
178) 622.2 (3.5
534
880

3.5
3.5
175
105
1225
2
24.5 Candles

Same ft lbs

60.9
191) 55.9 (318
573
350
191
1690

3.18
3.18
2544
318
954
10.1.124
2
20.2 Candles

$$V^2 = n(80-x)^2$$

$$= 6400n - 160nx + nx^2$$

$$(n-1)x^2 - 160nx = -6400n$$

$$x^2 - \frac{160nx}{n-1} = -\frac{6400n}{}$$

59 58 11 704

21

$$x = \frac{80n}{n-1} \pm \sqrt{\left(\frac{80n}{n-1}\right)^2 - \frac{6400n}{n-1}}$$

$n = 11$

$\frac{880}{10} = 88$

880
704
704
704

43 ohms
160 Cu. platinoid 22
7
730 75.4

4311) 33000 (7.6 per ft. 10
30177
28230
25866
2364 ft lbs

22 candles

4311 ft

4311) 43496 (4311
40216
3439
3021
1186
1079
1790

160 on lamp
175 on resistance

43

TAF

3) 297
99

169 Lamp
183 Resistance

169 : 182 :: 93.5
935
916
546
1638
169) 17070 (100.7
169
1170

16) 4311 (270
32
111
112

270 ft. lbs. per candle

4x

56·3
23·7) 56·3 (2·37
474
890
711
1790

2
561
2
1112 Candle

3700) 33000 (8.91
~~3700~~
29600
39000
32300
7000

R cold = 190 Ohms

Fibre
56·3

100 Volts

142 lamp

142) 182 (1·93.5
182
1876
7480
935
142) 170170 (1198 Ohms
142
281
142
1390
1278
1120

119.8) 443000 (3700
3594
8360
386

46

54.25
2575) 5425 (2.14 Tag X 4
5050
3750
2575
1175 0

4579
2
9,158

Side 9.1 Candles

10.5 candles average
10.5) 3700.0 (352.
315 11
550
525
250

352 ft. lbs. per candle
best filter

48

16) 4388 (ft. lbs.
32
118
112
60
273

383150

87.3) 383150.0 (4388
3492
3395
2619
7760
7604
7540

4388) 33000 (7.5 per H_2O?
30716
22840

180 Ohms old Regular Large Lamp
2800 Volts
3
93
49

22 Candles Broadside.

179 Lamp
167 on 93.5 Ohms
167 : 179 :: 93.5
179
4415
6545
935
167) 167365

179 : 167 :: 93.5
167
6545
5610
935
179) 156145 (87.3 Ohms
1432
1294
1233
615

50

64.75

1525) 64.75 (4.23
6100
3750
3050
7000

17.9
2
35.8 Candles

858) 44300.0 (5163. ft. lbs
4290
1400
858
5420
5148
2720

35.8) 5163.0 (144 ft lbs per candle from broad side
7
2506
358
1583
1432
1510

25) 5163 (206 ft. lbs per candle
50
163

100 Volts

51

Regular

64.75 P

197

181) 197 (93.5
~~93.5~~
~~197~~
~~6595~~
~~1815~~
~~9350~~

~~181) 18419.5~~

197) 181 (93.5
181
935
7480
935

197) 169235 (858 Ohms
1576
1163
985
1780

206) 33000 (160
206
1240
1236
40

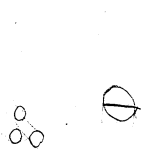
160 candles per H. P.

---

10 of 16 candles
each of the same surface
to much

.0162) 33000 (6.39 per H. P.
30978
20220
15489
47310

Impact = 6.39
10



3 inches long

.63	7.6	6.4
.63	7.6	6.4
	456	256
	532	384
	576	4096

41 : 58 :: 16 :
16
348
58
41) 928 (22.6
82
108
82
260

545
255) 545 (2.13
510
3 50
255
950

4.53
2
9.06
2
18.

18) 2079 (115
18
27
18
99

16) 2079 (129.
16
47
32
159
144
150

130 ft lbs for and

100 Volts

5415 Photo.

78 : 182 :: 93.5
182
1870
7480
935
78) 17017.0 (218.
156
141
78
637

218) 443000 (2079 ft lbs
436
1700
44

13

over

130) 33000 (254.
260
7700
650
500

16) 254 (16 per H.P.
16
94

Another fibre

56 on lamp

162 on 93.5 Tot

$\frac{270}{3}$ = 90 Volts

Photo 37

56 : 162 :: 93.5
162
1870
5710
935
56) 15247.6 (272.2
112
404
392
127
112
150

over

37

43) 37.0 (.86
344
260
258

.739
2
1.47

272) 358830 (1319 ft. lbs.
272
868
816
520
272
2480

Manilla fibre
100 Volts
65 on lamp
182 on 93.5 TAF

Photo 45

65 : 182 :: 93.5
182
1870
8480
935

65) 17017.0 (261 Ohms
130
401
390
117
65

over

Manilla fibre

45
35) 45 (1.28
35
100
70
300

163
2
3.2 candles

261) 443000 (1700 ft. lbs
261
1820

3) 1700 (566 ft lbs
15
20
per candle

Small paper loops

$\frac{250}{3} = 83.3$ Volts

~~109~~ 110 on lamp fail.

0=:1 ~~10~~ 1 on 93.5

1.54

110) 154 (1.4
110
440
440

93.5
1.4
3740
935
1309 ohms

52.5 Phots 7.3 candles

10.7 : 15.1 :: 93.5 : 1.4

93.5
1.4
3740
935
131.9

107) 1418.5 (131.9
107
340
321
198
107
91.5

52.5

275)52.5(

833 6938

112

2274

2202

1500

1320

1800

1650

1500

1320

1800

1650

1500

1320

1800

1650

Starting 3 candles from 200

ft. lbs.

$2^3 = 8$

$2.5 = 8\overline{)5.6}$

1.9
3
5.7

8)27
3.37
3
10.11

$3.5^3 = 8\overline{)42.8}$

5.35
3
160.5

= 24

Go Volts

TR 9

126 on lamp
119
160
163

56.25 Photo 11.25

119)163(1.37
119
440
357
830
783
460

93.5
13.7
6545
2805
935
128.095 Ohms

443
8100
443
3544
128)358830(2800 ft. lbs.
256
1078
1024

$\frac{280}{30} = 93.3$ Volts

T.P.

~~173~~ 126 on lamp

0=.3 ~~166~~ 169 on 93.5 Ohms

59 Photo 15.8 candles

```
126|169|134
   126
    430
    378
     520

   93.5
   134
   3740
  2800
  935
 12520.40
```

```
   8705
   44.3
  26115
 34820
 34820
 388631.5
 3756
  10031
```

3080 ft. lbs

$\frac{290}{3} = 96.6$ Volts

0=.3 ~~132~~ 135 on Lamp Taf

~~174~~ on 93.2

174

61.25 on Plates = 21.1 amperes

```
135)174(128
    135
     390
     270
     1200
```

```
 93.5
  128
 7480
1870
 935
119.680
```

```
 9282
  443
 27996
37328
37328
197)4134067(24544
    3591
     5430
     4788
      6420
      5985
       4350
```

100 Volts.

~~144~~ 144 on lamps

0=-3 478 on 93.5

181

62.75 Phots.

144)187 (1.26
144
370
288
820

935
1.26
3810
1870
935
1,160.10 Ohms

116) 443000 (3818 ft lbs
348
950
928
220
116
1040

3818)330000 (8.6
30544
24560

62.75

1725) 6275 (3.63

5175

11000

10350

6500

363

363

989

2178

989

121659

243 candles

7

1701 all round

16) 3518 (236

32

61

48

138

17) 3518 (224 ft lbs to candle

34 all round

41

34

78

$\frac{240}{3}$ = 80 Volt

TAP

49 Photo = 5 candles

0=0

111 on lamp

148 on 93.5

1.33

111) 148 (1.33

111

370

333

370

2805

2805

935

124355 Ohms

6400

443

19200

256000

256

124) 28055 (226 ft lbs

24844

3470

3468

9520

8708

1111

$\frac{230}{3} = 76.6$ Volts

104 on lamp

0=0 140 on 93.5

45 on Photo = 3.4 candles

104)140(134

104
360
312
480

93.5
134
3840
2805
935
125.390

5565
44.3
17604
23472
23472
2.093 ft. lbs.
25995.24
2504
715
8778
3720

$\frac{220}{3} = 73.3$ Volts

97 on lamp
134 on 93.5

41.5 Photo = 2.2 candles

```
97)134 (1.34      93.5
   97              1.34
   340             3740
   291            2805
    490           935
                 125.290
```

```
   5373
    44.3
   16119
  21492
 21492
(125.3) 23500 = 2.3 9 (1899 Watts.
        12533
        11272
        10024
        12483
        11277
         1206
```

Small lamp taken
No. 810 Glass well
cleaned

T.A.E.

$\frac{200}{3} = 66.6$ Volts

86 on lamp
122 on 93.5 Ohms

31.5 Photo. = 1 candle

86) 122 (1.42
86
360
344
16.0

93.5
142
187.0
3740
935
132.970 Ohms

4436
4.8
13208
17744
17744

1328) 1465148 (1.48
1328
6271
5968
19928
19928

70 Volts

93 on lamp

127 on 93.5

36.5 = 1.2 candles

```
93)127(1365
   93
   390
   279
    610
    558
     520
```

```
 93.5
  136
 5610
28055
 935
12616.6
```

```
44.3
 4900
3387 00
1772
21107 00
126
 850
 756
  947
```

1670 Volts

March 25th 1887 TAE

Best conditions.

Large bulb.
Most proportionate and correct bulb.
Small leading wires through glass
annealed glass where the wires pass.
High polish where wires pass through glass
Perfect cleaning of the tubes before blowing
A glass containing nothing that will
combine with Carbonic acid.
To heat the bulb the least bath
for convenience in handling and for
the prevention of chemical combinations
platinum Iridium clamps.
Clamp the conductor firmly with
a clamp that will spring together

and hold tight whether it expands or the Carbon wastes,

No iron or other material that contains much gas to be used in lamp.

Double sealing.

Heating the bulbs by sand bath when exhausting.

Very gradual putting on of current so that most of the gases are driven off at invisible heat,

place the clamps some distance apart,

Carbonize without oxidation and at highest practicable temperatures.

Have the Carbons flat if possible

The highest resistance combined with the smallest radiating surface,

Even resistances.

.723 Volts

99 on lamp

133 on 93.5

41.75 = 24 candles

99 | 133 | 134

99

340

297

43

93.5

134

3736

2805

935

12528 Ohms

5373

443

16119

21492

21492

1253 | 2380239 | 1900

4263

1127

$\frac{230}{3} = 76.6$ Volts

105 on Lamp

140 on 93.5

46.25

= 3.8 candles

105)140 (1.33

105

350

315

350

93.5

1.33

2805

2805

935

124.5 Ohm

5868

46.3

17604

23472

23472

1244 | 2880 (2.3

2488

1078 2

2080 Volts

80 Volts

111 on lamp

147 on 93.5

49.75 Photo

= 5.4 candles

```
111)147(132        93.5
    111            132
    360            1870
    333           2805
     270          935
                 123.420
```

```
      443
     6400
     1772
    2658
123)28350(2305
    246
     375
     369
       60
```

~~833~~ Volts

84 Volts

118 ohms amps

153 ohm 93.5 Ohms

52.5 Volts.

= 7.5 candles

```
118)153 (1.3        935
    118              1.3
     350            2805
     354            935
                   121.55
```

```
  7056
   443
 21168
25224
28224
312588 (2560 ft lbs.
122)
    244
     685
     610
      750
      732
       180
```

$\frac{260}{3} = 86.6$ Volts

123 on lamp
125
15.8 on 93.5 TM

54 Photo.
5.5
55.25
= 9.5 candles

443
7500
2215
3101

118) 3322.50 (28.10 ft. lbs
236
962
944
180

124) 158 (1.26
124
300
248
920

93.5
1.26
5610
1870
93.5
117.81

90 Volts

TEG

132 on lamp

165 on 63.5

57.5

= 12 candles

93.5
124
3740
1870
935
115.94 ohms

132)165(124
132
330
264
660

93.5
124
2540
1270
635
8740

443
8100
443
3543
3543
3090 watts

116)3583
348
1053
1044

93.3 Volts

TLG

140 on lamp
139

172 on 93.5

59.25 Photo = 16.2 candles

```
140) 172 (1.22
     140
      320
      250
       460
```

```
93.5
 122
1870
1870
935
11470 Ohms
```

```
8705
 443
26115
34820
34820
3856315 (3382 Ohms
14)
342
 436
 342
  940
  912
```

96.6 Volts

146 on lamp 119
147
177 on 93.5

60.25 Photometer 19 candles

```
146) 177 (121
     146
      310
      292
       180
```

```
  93.5
   121
   935
  1870
  935
 11 31 35
```

```
  9332
   403
 27996
 37328
 37 3 3 6
113) 7 13 - 0 7 6 (3660 Ohms.
     339
      744
      678
       660
```

4000
400

1.4
200
280
1.4
2
4
3

22.5
12

100. Volts

156 on lamp
183 on 93.5

62. Photon = 23.5 candles

156) 183 (1.17
156
270
156
1140
1092
480

93.5
1.17
55545
935
935
108.395

108.39) 443.000 (4080 ft lbs
43366
9400
1336

4080) 3300 (.8
3264
360

Summary Small paper book No. 2

Candles	Resistance	Watts	Foot lbs	
7.3	130.9	83.3	2348	
9.2	131.8	86.6	2490	
11.25	128.	90	2800	

$$x = \frac{80n}{n-1} \pm \sqrt{\left(\frac{80n}{n-1}\right)^2 - \left(\frac{6400n}{n-1}\right)}$$

$n = .5$

$80n = 40$

$n - 1 = -.5$

$$\begin{array}{r} 6400 \\ .5 \\ \hline 3200.0 \end{array}$$

$$\frac{80n}{n-1} = -80$$

$$\begin{array}{r} -80 \\ \hline 6400 \\ 6400 \\ \hline \end{array}$$

$\sqrt{12800} = 113.$

$$\begin{array}{r} 80 \\ \hline 33 \\ 27 \end{array}$$

108.9

226.9

1 candle 38

2 " 40

Ta?

108

$$x = \frac{80n}{n-1} \pm \sqrt{\left(\frac{80n}{n-1}\right)^2 - \frac{6400n}{n-1}}$$

$n = 1.5$

80
120.0
240

6400
1.5
32000
6400
96000
2
19200

$\frac{80n}{n-1} = 240$

240
96000
48
576000
19200
38400

240
19.9
461

3 candles $x = 46.1$

109

$n = 2$

$160 \pm \sqrt{160^2 - \cancel{80} \; 12800}$

$160^2 = 25600$
12800
12800

160
1131
409

~~160 ± 4 candles~~

6400
2
12800

TW

110 $x = \frac{80n}{n-1} \pm \sqrt{\left[\frac{80n}{n-1}\right]^2 - \frac{6400n}{n-1}}$

$x = 2.5$ $\quad \frac{n}{n-1} = \frac{5}{3}$

$n-1 = 1.5$

3 | 400
133.3

17800
10666
7134 (84.4
64
164 | 734
656
780

3400
5
17000
6800

6400
5
3 | 32000
10666.

133.3
84.4
48.9

5 candles

111

$n = 3$ $\quad$ 80 × 3 = 240

$n-1 = 2$

$\frac{80n}{n-1} = 120$

14400
9600
4800
120
69.28
50.72

6 candles

6400
3
19200
9600

TRY

$x = 3.5$

$x-1 = 2.5$

3.5
80
2800.0
1120
12544
8969
3584 (59.1
25
109 | 1081
981
118 | 1700

6400
3.5
32000
19206
2.5 | 22400.00
4
89600

112
59.1
52.9

7 candles

$x =$

$$\frac{80n}{n-1} \pm \sqrt{\left(\frac{80n}{n-1}\right)^2 - \frac{6400n}{n-1}}$$

$$\pm \sqrt{\frac{6400(x^2 - x + 1)}{(n-1)^2}}$$

$$\frac{80n \pm 6400}{n-1}$$

$$\frac{80(n \pm 80)}{n-1}$$

$$\frac{dn}{n-1} \pm \sqrt{\left(\frac{dn}{n-1}\right)^2 - \frac{d^2n}{n-1}}$$

$$= \frac{dn}{n-1} \pm \sqrt{\frac{dn^2 - d^2n^2 + d^2n}{(n-1)^2}}$$

$$= \frac{dn}{n-1} \pm \frac{d\sqrt{n}}{n-1} = \frac{d(n \pm \sqrt{n})}{n-1}$$

$$= d$$

$$x^2 = ba(d-x)^2$$

$$x^2 = ba\,d^2 - 2ba\,dx + ba\,x^2$$

$$(ba-1)x^2 - 2ba\,dx = -ba\,d^2$$

$$x^2 - \frac{2ba\,dx}{ba-1} + \left(\frac{ba\,d}{ba-1}\right)^2 = \frac{-ba\,d^2}{ba-1} + \left(\frac{ba\,d}{ba-1}\right)^2$$

$$= \frac{-ba^2d^2 + ba\,d^2 + b^2a^2d^2}{(ba-1)^2}$$

$$x - \frac{ba\,d}{ba-1} = \frac{\sqrt{ba\,d^2}}{(ba-1)^2}$$

TM

$$x = \frac{(ba \pm \sqrt{ba})\,d}{ba-1}$$

$$\frac{\frac{a}{b} \pm \sqrt{\frac{a}{b}}}{\frac{a}{b} - 1}$$

$$= \frac{ba \pm \sqrt{ba}}{ba-1}$$

$$\frac{a \pm \sqrt{ab}}{a-b}$$

$$a : x^2 :: b : l - x^2$$

$$a : b :: x^2 : l - x^2$$

$$= \frac{\sqrt{a}(\sqrt{a} \pm \sqrt{b})}{a-b}$$

$$= \frac{\sqrt{a}}{\sqrt{a} - \sqrt{b}}$$

$$x^2 = \frac{a}{b}(b - x^2)$$

$$\frac{a \pm \sqrt{\frac{b}{a}}\,a}{a-1}\,d$$

114 $a:b::x^2:(l-x)^2$

3)275
91.5

Lamp 210 110

TAF

~~[illegible]~~
134 ~~[illegible]~~ on Lamp

164 on 93 ohms

$\frac{250}{3} = 83.3$

Regulator	Lamp
245	121
254	125
261	129
265	134
270	136
280	141
283	145
290	150
295	154
305	162
295	158
290	153
283	151
275	146.5
268	141
250	128

Tab

Regulator

258	133
265	140
275	146.5
	147.5
283	151

Broke the circuit

282	151

Broke circuit

240	122
240	120
250	127
270	138

After some minutes lamp on

	142

lamp replaced no change

250	130

Starting machine

70	24
80	30
90	35
100	40
110	45
130	55
140	~~60~~
	65
160	75
190	90
200	96
210	102
215	108

Effort to Motion & M.F.

	250	129	
machine stopped	230	115	
	210	95	22
	200	89	
	190	80	FM?
	150	65	26
	170	60	10
	160	50	8
	150	42	0
	140	38	
	130	30	
	120	26	
	50	22	
	30	10	
	20	8	
	10	6	

I am asking to account for the irregularities observed in the lamp. I thought perhaps the lamps might lower their resistance after a time. It may possibly be in the clamps leading to the lamp.

Mch 30 1880 RAR

Lamp 810

$\frac{25.7}{3}$ Volts

FAR

12-32 132 TAR

12-36 135 TAR

~~267~~ ~~142~~

$\frac{25.8}{3}$ Volts 138

~~1-10~~ ~~171~~

Lamp 809 cold

$\frac{25.9}{3}$ Volts

1-10 171

1-18 $\frac{25.3}{3}$ Volts 168

165

285/3 Volts	152 = D
on lamps	152 = D
287/3 Volts	162 = D TIG

175 = D on 93. Ohms

Regulator on 93. Ohms

287	175
300	181.5
275	168
262	156
250	151
240	145
230	138

Taken off resistance for some minutes

230	141
~~190~~	

Made better shot

New adjustment Galvs.
Regulator On 93 Ohms

275	218
300	235 Tap
250	197
240	191
260	206

Waited a short time

265	208
280	223
200	158
190	150

$\frac{2\cos}{3}$ Volts

191 on lamp

54 · Photo

JAP

280 ÷ 3 = Volts

11.1/4 candles

199 on lamp

TAP

$\frac{300}{3}$ Volts

20.1/3 candles
21.75

222 on lamp.

222)235 (1.06 ohm
222
1300
1332

106)443 (4.180)33000 (8.
424
190
106
860

415

$\frac{290}{3}$ Volts.
16.25 candles

215

TDR

134 $\frac{312}{3}$

29 candles

k 63.5

235 on lamp

$\frac{250}{3}$ Volts

178 on lamp

5.5 candles

TAG

136 $\frac{204}{3}$ Volts

27

131 on lamps

$\frac{212}{3}$

1.1 candles

139 on lamps

137

TMR

138 $\frac{22}{2}$ = 11 volts

150

38.125 Photo

Fibre coated with plumbago

$\frac{150}{3}$ = 60 volts Ground side

228
144 ion 93 TAG
13.5 candles

140

$\frac{155}{3}$ Volts

61.6 Volts

235

12.25 candles edgewaysp

15 " broadside.

235 : 146 :: 93

93

438

1314

235) 13578 (57.7 Ohms

1175

1828

1645

1830

577) 168000 (291

1154

5200

5193

670

577

93

2912) 32000 (11.3

2912

3880

2912

9680

$\frac{190}{3}$ = 63.3 Volts Silver coated with plumbago 1/4

242 on lamps

242

19 candles broadside

16 candles edgewaysp

15 on 93.

TM

243 : 150 :: 93

150

4650

93

243) 13950 (57.4 Ohms

1215

1800

1701

990

574) 175830.0 (3003) 32000 (11.

1722

3630

3444

1960

3003) 33

16

16

176

10

35

255 : 150 :: 93 :

150
93
4650
93
255) 13950

24.5
200
4445
556
3

4.1445
2.4065
1.7380 54.7 Ohms

66.6 1.8235
1.8235
44.3 1.6464
comp 54.7 8.2620

3.5554
4.5185
.9631
1.3617
2.3248

~~Weight~~
3600
9.1
211 candles

2no
I
66.6 Nals

Fibre coated with Plumbago
Broad side

255 on Comp
255
TR?

24.5 candles Broadside
20. candles Edgeways

3600 ft lbs.

144

1/0 Salts Silver coaster 1/6d
3 with plumbings
Edge wrong

24 ~~7~~
16 Candles TA?

Lamp No. Replaced

R =

The carbon slightly inclined

142 on lamps T.A.P

$\frac{279}{3}$ Volts

11h 26' 950 grains

11h 28' 30" 940

152

$\frac{290}{3}$

$\frac{280}{3}$ Volts

148

Turning lamp

90°	~~54.55~~	53.55
80	~~56~~	53.8
70	53.4	
60	52.2	
50	52.2	
40	51.2	
20	49.~~75~~	
10		
0		

Regular No. 201

Candles 175.18

Deflection 275 TKP

Time H, M	
2-3	93 Volts
2-4	Started Calorimeter
	19°.2 C
2 9	24°.8
2 14	29°.8
2 19	35°.0
2 25	35°.0

35°
19.2
15°.8 C rise

1255 grammes water and copper vessel

772
9
5 | 69498
1389
276
8340
9730
2786
3836486

.002204
1255
.0022
2510
2510
2761.0

3836 | 33000 (8.6 per H.P.
30688
23120

1390

Time
2-36

Deflection 280

TR?

Wt of Cir. vessel and stirrer 103 kgrammes
Wt. Fluid 83
20 Cream & stirrer.

5 | 1390 pounds
276 days
4 lbs

1255
.83
1.172
2.2
2394
2394
2578.4

$3.89 per ℔
25
9723
6945
2778
$67.78

152

164 : 198 :: 91

91
198
1782
164) 18018 (109.9 Ohms i
164
1618
1476
1420

109.9) 258000 (2350 ampere
2198
38820
3297
5230

March 17

Comparison of galvanometer 150
with measurement of foot pounds
with calorimeter measurement
Small loop carbon

Time	Remarks
	91 Ohms in line for comparison with compass shunt.
12-4 P.M.	Engine stopped
12-10	" started
12-11 30	19.0 brought up to 100
12 13	230 Voltage battery
	$\frac{230}{3} = 76.6$ Volts
12h 17'	198 on 91 Ohms
12 18 30	20°.4 C
12h 19'	Started
12 20	~~D = 164~~
12 24	23°.7

3.3

H_2O

Cu

31.3 C
26.4
10.9 Rise
+ .1 Correction
11.0

Gives 33.9 grammes

.103
.2
206
206
.2266 C

1320
1320
1320
15290
267
107030
91740
30580
20 | 408240
20941
Heating 76
2057 ft. lbs

.2266
.095
11330
20394
.021517 &
150 hr
43034
21517
107583.
21517
323.01 | 1204 for 15 minutes
2.16.1 for 1 minute

Time	Remarks	
A.M.		151
12h 25	D = 164	
12h 26	$\frac{228}{3}$ = 76 Volts	2°8'
12h 29	Thermo. 26°5	
30	D = 164	
	76 Volts Tal	
12h 34	29°	2°5'
35	169 = D	
	76.6 Volts	2°3'
12h 39	31°3 Stopped	
12 42	205 on 91 Ohms	
	76.6 Volts	
12 59	31°	

1319 grammes
103 Copper should be
1216 grammes H_2O
Photo 58.6 ft 15 candles
Results Calorimeter 2057 ft. lbs.
Galvanometer 2350
Over

$\frac{1}{60}$ to be added since the weight alone of the vessel should have been subtracted ~~on~~ 82 grammes instead of 103

60) 20.81

34.7

2115.7) 2350 (1.11
2115.5
2350
2115
2340

Calor. 2115
Galvn 2350
Ratio 1.11

Temp. starting 20°.4 C = 68°.7 F
finish 31°.3 C = 87°.9 F

Cooled in 20 minutes 0°.3 C = 0°.52 F

204
9
5) 1836
367
32
687

31.3
9
5) 279.7
55.9
32
87.9
3
6
5) 87
52

Large loop March 17 1880

Calorimeter comparison with Galvanometer

Time	Remarks
P.M.	
9-39	204 on 91 Ohms
9-43	72.65 Lamp Alg

TR

138

778
10·6
4668
778
8246·8

1165 lbs
2·2
2330
2330
2565·3·8
8246
153.78
10252
5126
21504
10 | 2213.4498
2213 ft lbs
22
2235

174 : 2.00 :: 91

174 | 182.00 (104.6 Ohms
2·00
~~200~~
396
1040

775 Volts

106 | 265000 (2530
2092
55800
5236
3500

2235 | 2530 (113.2
2235
2950
2235
7150
6705
4450

Result Calorimeter 2235 ft lbs.
Galvan. 2530 ft lbs.
Ratio 113.2
Temp 71°.35 to 81°.95

Small carbon

TM

N9

Time	Remarks
10 P.M	
10 - 1	71°.35 F Started
10 - 3	173 on lamps
10 - 5	72 on lamp
	$\frac{231}{3}$ = 77 Volts
10 - 6	76°.65 F
10 - 7	173 - 175
10 9	174
	$\frac{235}{3}$ 78. Volts
10 - 11	81°.95 F Stopped
10 - 13½	200 on 91 Ohms
	1247 Grammes H_2O
	1165

76.65
71.35
5.30

8195
7665
5.30
5.30
1060

81.6 Volts

294.00

190 : 216 :: 91.

91
216
1944
190
19056 | 103.4 Ohms

61.0
3.0
56.0

103.4 / 29400 | 284
2068
8720
8272
4580

28.40 ft lbs

Small Carbon

TR9

Time	
11.48	56°85 F
12-00	66°85
12-2	232/3 = 77.3 Volts
	.175 on lamp
12 5	Stopped the engine

Small Carbon No 553

Time	Remarks
12h 19'	294/3 =
12h 22'	245/3 81.6 Volts
12h 23'	60.97 Started
12h 26'	244/3 81.3
12h 27'	67°37
12h 28'	189 on lamp
	244/3 81.3 Volts

67.3
60.9
6.4

798
60.9
18.9

Correction 3
19.2

19.2
772
384
1344
1344
1482.4

18.9
772
378
1323
1323
1459.8
2.62
29182
87546
29182
38228.42 ft lbs
.15
2568
25
2593 ft. lbs.

H_2O then 1.275 kilo
cu 82
H_2O .1193
22
2386
2386
2.6296

2593) 2840 (109.5
2593
24700
23337
13630

Time	Remarks
12h 33'	73°.55 7
	246 / 3 = 84.6 Volts
12h 36'	79°.87 Stopped
	216 ... 91 Ohms
12h 41'	232 / 261 / 93
	246 / 3 = 82 Volts
12 48	79° 2 7

T 73.5
232
260
492
246

73°.55
5.3
6.25

79.8
73.55
6.25

Wt. 1.275 kilo

Calorimeter ~~2.8~~ 2286
Galvo 2840

2286) 2840 (124
2286
5540
4572
9680

March 18 Tal

Tried a small lamp in air 192 = Deflection, placed the lamp under water 192 = D or as near as I could judge the same. This shows that the temperature of the glass has very little effect on the resistance of the carbon and consequently the ~~heat~~ amount of energy given off from the lamp. This the reason is probably that the carbon is of as high a temperature ~~that~~ say 2000°C then 50°C change in temp of surrounding will change the carbon only 2½ % or as its resistance falls ⅔ from the original the change will not be more than 1% and ~~among that the last changes in resistance~~ ~~small~~

Tried the deflection of the line To H.R. Galva = 246 (Feb 16)
Placed the wires around the lamp direct = 246
This shows that there is no fault in E.M. 7
Next change batteries

Internal resistance 4 cells
20 Ohms 5 Ohms each

1 Old set	320 = D
1 Old set	310 = D
Fresh cells	320 = D
Fresh cells	321 = D
Old cleaned	311
	315 deflection
	316
	319
	320

6300
2
12600
2
25200
6300
18900

25200
5.45
126000
1008
1260
13734000

100
200
400
800
1600
3200
6400

18900
73
56700
1323
3777

6300
1400
7700

291
47
2037
1164
13677

292
47
2044
1168
13724

Test of galvanometer
how resistance THI

Resistance	Deflect	Product
25200	5.45	13734000
18900	73	13797000
600	109	13734000
6300	218	13734000
4700	291	13677000
	292	13724000
	2	

O.K. Zero point changed

170

761
66.8
9.37

1300 Grammes
82
~~7218~~
.0022
2436
2436
26796 lbs

778
9.3
2334
7002
7235.4
268
5788.0
4351.0
1447.0
19400
1940
.19
1959

Wt of vessel 82 grammes

171 : 200 :: 91
200
171 | 18200 (106.4 Ohms
171
1100
1026
740

106.4 | 259000 (2430 ft. lbs
~~1064~~
~~1260~~
2128
4620
4256
3640

1959 | 2430 (1.24
1959
4710
3918
7920

Small Loops

171

Time	Remarks
P.M.	
11-37	D on Resistance = 91 Ohms 201 High resistance newly arranged 201 = 215 225 ~~= 215~~ see page 167
11-40 +30"	Start! 66°.87
11 41	171 on Lamps 172
11 42	205 = 215 H.R. 225
11 46 3/4	71°.45
	172 173 on lamp 205 = 215 71.6 Volts
11h 50' 3.5"	76°.1
	198 on resistance 199 Total Weight 1205 grammes 0 = 0

71.45
68
4.55

761
32.5
43.6

Burning Small corpse
TW

177

951205 : 51
51
205
1025
95) 1085 (110 Ohms
95
95
68.3 Volts

110) 2050 (1873 Ft. lbs
110
950
880
680
770
90

1734) 1873 (107.8
1734
13900
12138
1762

778
835
3890
2334
6224
6996.30
266
38976
38976
12992
172979.36
17394

1.292 Grammes
83
1.209
2.2
2418
2418
2.6598

Test by means of resistance in line with the lamp
Tae

Time	Remarks	
a.m. 8-42	Resistance ~~of~~ in line 51 Ohms	
7-50	68°55 Started	
	891 301 311	7255 68.55 436
1-55	72°55	
1-57	205 Lamps	
1 58	95 on 51 Ohms	76.9 72.55 4.05 4.10 8.35
2h	76°9	
	1292 Grammes	

176

91 : 213 :: 45.1

417
213
1065
852
91 | 19383 | 1055
91
506
455
51

Ohms 71 Volts ✓

223.200 | 2116
211.0
12.30
10.55
17.50
10.55
6.95

Galvo.

1266
.53
1.183
2.2
2366
2366
2.6026

13.15
778
105.20
92.05
92.05
100.30.70
26
6018.0
20060
15 | 26078 | 1738
15
110
105
57
75
128

1755 | 2116 | 1.20
1755
3610
3510
1000

83.8
70.65
13.15

177

Test small loop

T&G.

Time	Remarks
am	
2-23	45.1 Ohms in line
2h 29'	70°.65
2h 30	213 on lamp 91 on 45.1 Ohm
2 34	75°.17
2 37	215 Zero 2 to left
2h 39'	208-219 = 213 on lamp
2h 39'	79°.6
2h 41'	90 on 45.1 Ohms
2h 44'	83°.8

291
213
78

302

75.1
70.65
4.45

79.6
75.1
4.5

83.8
79.6
4.2

1266 grammes
Galvo 2116 ft lbs
Calor 1755 " "
Ratio 1.2
Temp start 70°.65
end 83°.8

90:207 :: 45.1

45.1
207
3157
902
9335.7 :: 70 Volts

10.3 Ohms

10.3)217000(2092
207
9600
9333
267

1300 Grammes Total Wt.

53
1277
243
3
2677

1988)2092(1.05
1988
10400
9940
4600

66.3
5.7
14.2
7.8
7136
994
994
110477.6
2.68
88836.8
66282
22554
15)295658.8(1970
15
145
135
186
105
5

Seek small loops

+h9

Time	Remarks	
A.M.		
3.15	52°.1	
3.17	205 on Lamp	
3.19	90 on 41.5	56.85
3.20	56°.85	52.1
		4.75
2.22	210 on lamp	
2.24	210	61.6
2.25	61°.6	56.85
		4.75
2.30	66°.3	66.3
		62.4
		4.9
	1300 Grammes H_2O Vac.	

1988 ft. the calorimeter
2092 " " Galvanometer
Ratio 1.05 Temp at start 52°.1 and 66°.3

70.3 volts

89 : 211 :: 45.1

211
45.1
902
89 | 95161 (1068 Ohms
89
616
534
82

1068 k. gross (2050 ft lbs
2126
8400

1330
83
1251
22
25022
2502
27522

141
778
1128
87
109698
275
54845
76783
21938
15 | 301164.75
2010
20
2030

2050 Galva
2010 Calorimeter
2030 | 2050 (1.01
2030
2000

Small carbon

TAG

Time	
A. M.	~~45 Ohms in line~~
3 - 55	52° 35 Standing
4 - 20	53° 75
4h 22' 50"	53° 75 Started
4h 24'	211 on Camp
4h 27' 50"	58.6
4 30	211 on Camp 89 on 45.1
	63° 35
4 35'	0 = 0 89 on 45.1
4 37' 50"	67 85 1384 Grammes

58.6
53 75
4.85

63 35
5.6
4.75

67.85 - 67.85
5.375 - 6.335
1410 - 4.50

45 Ohms in line
Temp. air 62°.57

Over

A. M.
43.5 — Temp air 63.3

TAR

Calor. 2050 ft. lbs
Calor. 2030
Ratio 1.01

Temp. start 53°75
15 minutes end 67°85

I want this series

Try three measurements with shunts and with resistance in line

(3) start below temp. air and time then run above temp. air a similar and times 5° 10° 15° about

(3) Try very hot and cold

Try below 15° to temp air

(2) ~~[illegible]~~ Temp air to above 15°.

(1) Try stirring constantly 15 minutes and no stirring until end 15 minutes. Tried 35 minutes

95 : 259 : 91.4

91.4
1036
259
23311

95) 2367 2.6 (24.9.2
190
467
380
872
855
17.0

1737) 33000 (19
1737
15630

413000 (1737
2492
18380
17444
9360
7486
18740

658
54.6
11.20

778
1.12
1556
778
778
871 3.6
2.67
60991
52278
17726

15) 2.3 26 8.7 (15 50
15
82
75
76
75
137

15 50
15
1565 ft. lbs

1565) 33000 (21
3130
1700

1295
.82
1213
2.2
2426
2426
2.6686

Lamp No 9.25 R = 450

Time | Time

10.40 | 91.4 Ohms in resistance

10-12 | 259 in 91.4

11h 14' | 54.6

11h 15' | $\frac{290}{3}$ = 96.6 Volts
95 on lamp | 622 / 56.0 / 7.6

11h 24 | 62°.2 F

11h 25 | 94 on lamp
$\frac{282}{3}$ = 94 Volts | 65.8 / 62.2 / 3.6

11h 29' | 65°.8 F
1295 H_2O Ohm

1.40 | Temp air 68°.5
12 | 67°.5

103 : 170 :: 69.5

```
      170
     ----
     6950
    6950
103 | 11815.0 | 114 Ohms
    | 103
    |-----
      15.1
      103
      ----
       485
```

3 | 170
56.6 Volts

```
114 | 142000 | 1245 ft. lbs.
    | 114
    |-----
      280
      228
      ----
       520
       456
       ----
        640
```

Lamp No 853
R = 172
Small carbon

Tal

Time		
12:30	54°.85 7	67.5 6.75 54.8 12.1 12.7 7.46
	D = 275. 91.6	
34	970 on lamp	58 54.85 3.15
12h 35'	68°	
12h 36'	58°4	60.8 58.5 2.3
12h 40'	60°.8	
12h 41'	98 } 103 on resistance 108	
	D = 0 20 m. inch = 64	63.7 60.8 2.9
12h 45'	63°.7	
12h 47'	99 } 103 on resistance 104	66.5 63.7 2.8
12h 50	66°.5	
	Stirred each five minutes.	
12 52	about 170 on lamp	

74.35
54.85
19.50
178
1560
×365
1365
15171.0
2.73
45513
106197
30342
35)4141683(11943
35
64
35
291
280
116

1825
82
1.243
22
2486
2486
2.7346 lbs

11.95)1245(1.042
1195
5000
4780
2200

Ratio 1.04

Time		
12h 25m	69°1	Tot 69.1
1 —	71.6 Gehl	69.5 / 2.6 — 72.6 / 69.1 / 2.5
1-4	170 on lamp	
1-5	74°357	74.35 / 71.5 / 2.85
	1325 Grammes	
	69.5 Ohms in line	
1h 35	65°7 Temp air	

1288
82
1206
22
2412
2412
2656 : 2

74.55
553
19125
778
15400
13475
13475
149765.0
265
74880
89856
29952
35) 396860 (1133
35
46
35
118
105
136
11
1144 ft lbs

1195
1133
62 6%

1133 ft lbs no stirring
1195 " " stirred

When the calorimeter is not stirred a hot layer of water covers the top which gives off heat faster than if the water were all of the same temperature. That is the calorimeter will show less

Lamp No 853
R = 172
Small carbon TAR

Time	Remarks
2 - 13	55.3 started
	D = 170
	No Stirring
2 47	D = 170 on lamp
2h 48'	86° before stirring
	74°55 ¶ after stirring stopped
	264
	280 D = 275 Total
	544
	1288 Grammes

243 : 248 :: 91.4

91.4
992
248
2232

243) 226672 (93.2
2187
797
729
680

) 358.800 (3850 ft lbs
271
7920
7456
4640
6

75°05
58.65
16.40
778
1312
1148
1148
1275.92

1.361
82
1.279
2.28
2558
2558
2.81138

1275.9
2.81
1275.9
102072
255.18
358527.9
36
3621

Calor 3585 ft lbs

3621) 3850 (1.0063
3621
22900
21726
1174

Lamp No. 853
R = .172
TAG

Time		
3h A.M. 59	270	90 Volts
4h	58°65	Started
4 1	231 ?	Gale
4 2	238	
4h 5'	67°7	Stirred each minute
4 7	242	67 58.65 835
4h 8	244	
4h 9	245	
4 10	75°05	Stopped Scale moved
4 11	243	7505 67 805
	248	on lamp & on 91.4 Ohms
	244	
	270 = 90 volts	1361 Grams

say 3850 ft. lbs. Galvan

7215	1315	
55	82	
17.05	1.233	1326.0
7.778	22	2.71
13.640	2464	1326
12935	2465	9282
11935	2.712 5	2652
1326409.0		359.3460
		36
		3629

3629

Lamp No. 853
R = 172
TNG

Time	Remarks
4 34	55°.17 S
4 35' 30"	Started
	270 ÷ 3 = 90 Volts
4 33	242 = 241 for gas connection
	242
4 40' 30"	640
4 45' 30"	72°.15
	246 G = +1
	245
	1315 Grammes

Lamp No. 618 perfect carbon gray steel like lustre no change or blackening has burnt 1000 hours also sign of irregularity at red heat.

11 42 16
11 18 35
23 49
60
1380
49
1429 + 600

2029
130) 2029 (156 ac
130
729
650
79

11.37.5
11 18 35
18 30
60
1080
30
1110

1350
1280
170

15 : 156 :: 2a

15) 312 (208 candles
30
120

Time	Remarks	TAQ
a.m. 11-10	Regular lamp No. = 618 R. = 150	
	Moderately clear globe Broad side. General arrangement in Photo. broad side of lamp	
	88.2 Turns in resistance with good [illegible] all [illegible]	
11-18-35	Wt with [illegible] balance 1350. grains	
11-32	H.R. Galvo 65 = 20 cells 275 / 3 = E.M.F. = 92.66 Volts 173 = D on [illegible] 170 = D on 88. 20 Ohms	

200

60.78
60.62
1.30

Photo 60.7 21 candles
[illegible] 8 candles
[illegible]

173:170::89.2 1.9504
2.2006
7.7619
1.9429

87.7 Ohms

92.6 1.9661
1.9661
1.6464
8.0570
3.6356 4320 ft. lbs.
4.5185
.8829 7.6 per H.P.
15.4 1.1875
2.0604 114 candles

Lamp 618 201

Time	Remark	TR
1:33	Photo 60.78 20 candles	764 / 30 / 10780 / average 154
1:37.5	On scale 1280 grams	
1:38	60.62 Photo.	
1:47	Side 53.25 8 candles	(Edge)
	173 on lamp	
	170 on resistance	
	278 on H.P. Valve 92.6 volts	
1:52-16	1270 Grams	
	89.2 Ohms in resistance	

20.27
137 15
23 12
60
1110 1380
1026 12
90 1392 (15.4
96
492
480
420

15) 308 (205 Candles
30
80

+ 2½%

Ohms in lamp

87.5 Volts

Lamp No. 618 TRG 283

Time	Remarks
P.M.	2.61 on H. R. Galva
1-20	87 volts
	164 ± 0
	165 ± 0 on lamp
	162 ± 4 on Resistance
1-33	164 on lamp
	263 on H. R. Galva
	87.6 volts
1437 ± 15	1110 Grains
	~~Side~~ (Edge) just one side of aluminum
	50 ± 45 Photo
	5.3 candles
1-41	H. R 2635
	166 on lamp
	Shadow of one (side) Edge
	47.2 Photo
	4.2 candles

Lamp No. 618 Tag

Time	Remarks
	Boracic acid
1.52	58.2
1.53	58.7
1.55	57.1 58.[illegible]
1.56	56.30 14 candles
1.56.45	58.22
1.58	57.[illegible]
1.59.30	58.[illegible]
	[illegible] 17
2.00-27	1020 grains
	164 in lamp
	$\frac{262}{2}$ = 8.11 F

107 : 125 :: 894
× 5
4476
788
894

107) 111750 (1044 Ohms
107
475
428
470

4570
443
1371
1828
1828

104) 202451 (1946 ft. lbs.
104
964
936
480
416
640

Lamp No. 618 TEG

Time	
2-5	2 Candles Brass side
	203 on H.R
	676 Volts
	107 on lamp.
	125 on 894 Ohms

92.9) 256000 (2755 ft lbs
1858
7020
6503
5170
4645
5250

136) 140 (103
136.
400

90.2
103
2706
902
9290 Ohms

Lamp No. 618 TRE

Time	Remarks
P.M. 2-15	228 / 3 = 76 Volts 136 on Lamp 140 on Resistance 49 Photo 5.1 candles

90.3) 320.000 (3542 ft lb.
2709
4910
4515
3950
3612
2380

Santa Fe 618 tag

Fine

5" 1.5 on Photo
159 on 90. = 6.5 amperes
162 on Lamp

$\frac{255}{3}$ = E.M.F.
= 85 Volts

2.25 90.2 Ohms

Lamp No 6.18 TAE

Time	
2.31-15	900 Grains
2.32	$\frac{277}{3}$ = E.M.F
2.35	172 on Resistance
	Changed current

$\frac{35800}{3977}$ = 9 Volts

Lamp No. 618 Ta E

Time	
3-16-10	750 Grains
3-12-50	New Centerpoint 148
	Roadside Photo. 59.85 16.5
3-25	$\frac{270}{3}$ = E.M.F. 90 Volts
	170 on lamp

85.1) 454000 (5333 ft lbs.
425.5
2850
2553
2970

198 : 187 :: 90.2 :
90.2
374
1683
198) 16867.4 (85.1
1584
1027
990
374

37
77
259
259
2849
28.49

5333) 33000 (6.2 for H.P.
31998
11020

28.5
6.2
596
1710
16) 176.90
11. for H.P.
16 each

6.2/11 surface of regulator to give 16 candles or at 11 for H.P or 8 indicated.

Lamp No. 618 Regular

Time	Remarks	Tag
3-27	65.8 Photo	
	85.4/3 = S.M.F.	
	101.3	
	198 on lamp	
	187 on Resistance	
3-30	65 on Photo	
	64.9 on Photo	
	64.75	37 candles
	65.25	
3-41-38	1370 grams	

27
62

Lamp No. 613 R 190 749

Time	Remarks
	Small carbon. Blackened a slight irregularity in the various portions
4-11-10	795 Grains
	44.2 Watts.
	20.3 / 2 Volts
4-06	90 on lamp ~~[illegible]~~ ~~[illegible] gaba removed~~
	92 on lamp
14-249	225 on H.R. Galvan
	128 on Rectifier

Lamp No 813 Mag

Time	Remarks
4-8	Side (Edge 31.2 Photo Wrong to 34.1
4-12	91 on lamp screw driver near lamp ~~[illegible]~~ E.M.F.: 3 Screw driver removed 92 on lamp 128 in resistance
4-25	Good zero on both galvanometers. 20 cells gave 65 sharp Resistance boxes = 90 Ohms

Lamp No. 813 223

Time	Remarks
	The magnet on small bridge Galva removed and deflections taken This will make the deflections which follow discordant with those preceding
	Zero
	99 on lamp
	215 on H.R. Galva
4-57	132 on 90 Ohms
5-5-20	500 grains candle changed
5-7	Side (Elap) 35.5 Photo

224

Edge 35.5
1.2

Lamp No. 8.13. 225

Time	Remarks
5-8	97 on lamp 212 on H.R. Salmon 46# 2 - Broadside
5-10	213 H.R. 214

137 : 171 :: 90
90
137) 15390 (112.4 Ohms
137
169
137
320
274
560

8281
943
24843
33124
33124
112.4) 3668423 (3246 watts
3372
2864
2248
5168
4496
6720

3246) 33000 (10.16 H.P.
3246
5400
3246
21540

5 25 45
5 5 20
20 25
60
1200
25
417) 12225 (1475
83
395
332
630
581
490

-2%

61.75
63.25
63.1
188.00
62.6

26 candles
-2% 25 candles

Lamp No. 813

Time	Remarks	Watts
5-15	Phots 61.75 Bunsen	
	272 H.R. =(90.6 volts)	
	135 on lamp	
	168 on 90 Ohms	
	137 on lamp	
5-17	275 H.R.	
	Blue, Phosphorescence in Globe	
5-21	63.25	
	63.1	
	274 H.R. =(91.3 volts)	
	139	
5-25-45	417 grams.	

Galva

92
92
184
828
8464
44.3
25392
33856
33856
3749.5 8.2

135 : 167 :: 88.5
167
6195
5310
885

135) 14779.5 (109.3 Ohms
135
1279
1215
5745

109.3) 37495 (3430
3279
4705
4372
333

Test with calorimeter of Galvanometer March 24 1890

Water from Deans well 48°F

all the connections with galvanometer the same as yesterday

Time	Remarks
11 M	Lamp No 813 Small Lamp. R 190
11 10	Temp. water in calor 51°3 F (Started) Temp. air 62°5
	62.5 / 51.3 / 11.2 / 62.5 / 73.7
	Inside warm
	Calor. dry
11 12	H.R. 276
11 14	135 on Lamp Stirred
11 15	58°87
11 16	H.R 276 = 92 Volts
	135 on Lamp
11-17	Stirred

1241
83
1158
2.2
2316
2316
25476 lbs

74.75
58.5
15.95
78
1272
1113
1113
12370.
254
4948 03
61850
24740
10 | 3141.9.85 3141 ft. lbs

58.5
67.3
7.5
66.5
58.8
7.7
74.75
66.5
6 | 8.25
137
6.88

74.75
67.3
23.48
772
458
1638
1638
18354.8
25.5
90320
98320
36128
46063.20 (3070
45
106
86

3070 ft. lb. cubic
3070 | 3430 (1.11 Ratio
3070
3600
3070
530 .16

Time	Remarks
11-20	66.5 uncertainty about the time one minute divisions to the second and minute hand not corresponding
11-22	Started
11-25	74°75 F (Stopped)
	167 on resistance 85.5 Lamp temp. 60° F
	0 on lamp resistance
	1.5 Ω so that this must be added
	1241 by rains Holden Rhs
11-46.50	380 grams
	147 Lamp
	171 Resistance zero adjusted
	277 H.R Galva
	63.31 on Photo 39 inches
	Eye from day light

80.025 thermal units required to melt 1 ice dollinn

5 | 80.025
16.005
9
144.045
778
1152360
1008315
1120215
11206.7 ft lbs

.465 kilo
2.2
930
930
1023.0 lbs

111.067
1.023
333201
222134
111067
30 | 113362.1
3787 ft. lbs

The ice was fine and quite dry and also had some lamp black mixed with it. It was not given full time to drip.

Calorimeter 5910
Calorimeter 3787

3787 | 5910 (1.7
3787
21230

Time	Remarks See page 238
	Experiment with ice calorimeter
	Cu. cell placed in circuit with lamps.
2-43	The outside and inside filled with ice
	Vessel placed so as to catch
2-43	The drip [illegible] inside (This time taken)
2-47	Glass placed under
3-26	12 minutes 33.1 grams per minute 2.8 grams
16	10 20 30
3 17	40 50 8 27 45 Drip every 19 seconds
3 22	25 seconds 24 seconds

Grams 129.8
13.3
7.55
7215
grams 30.5

74.9) 443000 (5910 ft. lbs

3745

6850

6741

1090

216 | 182 | 89.31

182

1786

7144

893

216) 16252.6 (74.9 ohms

1518

1072

864

2080

Wt Cu plate
14.776 Lawson

3 36 Started

216 on lamp
300 on H. R. Galvo

3.42 Water commenced to drip
fast - 302 H.R

3-44 94 drops per minute

216 on lamp
302 on H.R.

4-1 302 on H.R
216 on lamp

4-6 Stopped

216) 182.0 (.842
1728
920
864
560

87.3
.842
1786
35 72
7144
73.4906 Ohms

Volts
75.2) 100.3 (1.334 Webers
752
2510
2256
2540
2256
2846

30 / .7219
.02406 Mg
24 mg per minute

1.334) 2406 (18.0
1334
10720
10672
4800

18 mg. per minute

Ice calorimeter

Wait until a drop every 25 seconds then it may be assumed with reason other exact.

#1 182 on resistance.
at 63.7 °C 89.3 Ohms

15.4 79.5
10.7 9.8
.7219

The cell and leadings wires above 10 Ohm

4.35 Weighed Water, glass .550 grammes
.106
444
185
.4625 grammes

65.5
47
185

say .465 Grammes

The cells used as standard ~~was~~ had changed there E.M.F as is shown by the deposition of Cu.

Note July 1550 The Cu. deposited 18 mg. per Weber for minute shows that the cells were badly plugged out

$18^2 = 324$ 2.5105

$19.6^2 = 384$ 2.5832

.9273

84.6 % of results

Fine Lamp No 705
R = 225 Ohms

Time	Remarks
P.M	
8-26-20	320 grains
	Good zero
	H.R 2550
	118 on Lamp
	Broadside 53 bis
	Edge 51.2
	165 on 58.5 Ohms

103
103
309
103.
10609
4403
21211
6 2 2 3 6
12436
469978.7

133 : 184 :: 88.5
184
3540
7080
885

133) 16284.0 (122.4
133
298
266
324
266
580

122.4) 469.978 (3840) 33000 (8.6
367 2
10277
9792
4850
4896

30720
2280.0
140

8.6 per H. P.
15 candles each

14
86
14
344
86
1204

Fibre lamp No. 705.
R = 225 Ohms

Time	Remarks
	58.5 Photo
9.40	309 H.P. 133 on lamp 184 on resistance
941	265 grains
	8½ per H.P. 15 candles each 14 candles all round
	306 H.P. 132 on lamp 57.55 Edge 58.3 Photo 57.4 Edge

265 : 280 :: 168 :

280
13440
336
265) 47040 (177
265
2054
1855
1990

182 : 177 :: 88.5

177
6195
6195
885

182) 156645 (86
1456
1104
1092
125

86) 345000 (4244
324
210
172
380
344
360

page 232

112067
15
560335
112067
40) 1681005
4202 ft. lbs

.684
22
1368
1368
15048

Ice Calorimeter March

Time	Remarks
8.30 9.25	Started.
9.28	Drop.
	265 H.R = 88.3 volts
	182 on lamp
10-5	Stopped
Weighed in the morning	790 grammes 106 684 grammes
	The ice was cleaned from this and some larger lumps introduced.
	The deflection on resistance calculated

File AF

Plating Cu

Time	Remarks
	Ex. made by Yale
7-36	E.M.F. $\frac{280}{3}$ = 93.3 Volts
	Plate 15.4915
	.165 in ~~lamp resistance~~
8-6	stuffed (Cell .64 Ohm)
	R = 86.5 Ohms
	Cell = .5 Ohm (Total 89. Ohms)
	plate 16.070

$$\begin{array}{r} 15.4915 \\ \hline 10.5\,\big)\,.5785\,\big(\,.551 \\ 525 \\ \hline 535 \\ 525 \\ \hline 103 \end{array}$$

$$89\,\big)\,93.3\,\big(\,1.05 \qquad \begin{array}{r} 89 \\ \hline 430 \end{array}$$

$$30\,\big)\,.551 \qquad .01833 \text{ mg.}$$

in Weber per minute.

9-10 One drop in three minutes

Good zeros

30 cells 65 R.H.

Temp cells 57° F fair condition

9-45 Started

H. R. 290 L
292 R

200 m Lamp

Temp about 60° F

198 on hands

0 Low resistance 2 Ω

10-15 Zero reset

195 on lamp

Time 10-5	The shunt cut out by wire and current passed through resistance
10-8	285 L H.R
	287 R H.R
10-5	172 on resistances
	Temp coils. 53°7
10-10	178 on resistances
	292 R on H.R
	172 on resistance
10-14	287 L H.R
	Good zero
	20 cells. 65 L 6575 R
10-17	293 R
10-19	198 on lamps

9cc Calorimeter 251

Time	Remarks
10-40	198 on lamp
	292 R on Galvo
	Good zero
10-51	172 on resistance
	2872
10-55	Changed
	Wt on vessel 62.5 grammes
	Wt Glass H_2O 1116.5 gm
	106
	H_2O = 1060.5
11-3	Wt glass nothing 110 grammes
11-5	Glass H_2O 127
	110
	H_2O = 17 grammes

.0423 in free small tap

3/287

95.6 Volts

198 : 172 :: 881

172

1762

6167

881

198) 151532 (76

1386

1293

1288

76) 406000 (5342 Ft lbs.

380

260

228

320

304

160

Ice Calorimeter

11-10 Placed glass vessel weighing with H_2O 127 grammes or 126.75 under

Cu SO_4 287 grammes

625

2245 Wt. H_2O

1013.5

17

1252.0 Grammes H_2O

11-15 172 on Resistance

287 L H. R

198 on Lamp

20) 348.25 (
17.41 grammes per minute

.0174
2.2
3.45
345
.0 2 2 8 pp 232 112067
1038 3
336201
89 6536
33 6201
929 21661

17.4 19.5

~~302~~ 380

302) 380 (1.22
302
780
604
240

Gee Calorimeter

11.23 196 on Temp
255 H.R.
11.24 [illegible]
255 H.R.
11.27 Temp [illegible] 58.7 / 5.5 — 53.25
195 on Temp
255 H.R.
11.30 Stopped [illegible]
Results
Wt [illegible] 475
.1267
20 | 348.25 grams

1.765
2.2
3530
3530
105) 3.8830 (.037
315
733
735

112067
.037
784469
336201
4146479

4146 ft lbs

Result

Calor	20 minutes	4292	ft. lbs
	105 "	4146	
Calor		8842	

4292
4146
8438

Ratio

4219) 5342 (1.26
4219
11230
8438
2920

11-40 Cu vessel taken out
glass put back

11-45 Resistance 88.1 Ohms
wt cu H_2O 345
287
58

2-10 Wt glass vessel 67 grammes
placed and 20

Wt glass and H_2O 562
3 P.M drop every 45 seconds 475
87
345 ÷ 2.5
60
45
105 mm/Kilo
1252
Total Wt 1745 25
20
1765
67

40) 7833
.01958

90) 95
1.055) .01958 (.0185 mg.
1055
9030
8440
5900
5275

Fine Cu plating

3-12	1.75 on resistance
3-25	65 temp resistance
3.52	Stopped (40 minutes)
	170 on resistance
	89.5 Ohms
	285 on H.R.
	95 Volts
	16.8533 Wt Cu
	16.0793
	.7833

Seat of cells

P.M.
4-22

Shell 205
198
195
195
205
988
197.6

Fresh cells 205

Bottle 2.580 litres
49
23220
10.320
Kilo 125.420 litres
or 2.2
25284
25284
278.124 lbs

278
778
2224
1946
1946
2162284
5.65
1581420
1297704
1581426

15 | 1222.01 | 81466
120 | 13577
22
15
70
60
100
90
10

95043

3. Ohms Calorimeter

345 on machine
2 all open

11-20	Started
	63.67
11-26	66.5
11-35	69.25

69.25
63.67
5.65

350 Calorimeter
43
6
258

1250
83.3

30000
102000
17
119000

Dynamometer

944	948	949
1 003	1000	1000
1947	1948	1949
973	974	974

Edison

971 m
973 without load
972 average

872 average with load

10.92 corrected gage pulley
188 for engine belts

8736
8736
1092
2052.96

102.648 ft. lbs. Dynamo
95.043 ft lbs. calor

2169

1080
60
2160

50 : 218 : 216
215
1728
216
432
47098.8
94.18 volts

102.6445 Mfg by Dyne
Upton

216200
71
216200
15794
15 | 1540200 | 102.6200 Mfg,
15
41
30
110

Dyne monometer 2167

2-5 970 lbs running
free
69.4 7
2-15 started
870 very good
2-30 76.5 76.5
60.4
7.1
2 volts 50
218

Test of Pony with 269
Edison dynamometer

3-M
2-35

March 30 1911.

11 feet

975 revs

~~928~~
927 Dynamometer

975
~~975~~
10745
5

1130 revs full
speed of machine

6 lbs at

12 3/4 feet

978 revs

907 on Dyne.

12.75
2
76.50
978
6020
5355
6905
75007.00

2052 regular speed of lathe

1130 : 978 | 2052 : x
978
16416
14364
18468

1130) 2006856 (1775
1130
9768
9040
7280

887 dyne
980 revs

13 feet

7 1/2 lbs

13
7.5
68
91
97.8
980
78240
8802
95844.0
15000
20844

Bonny Matthews
Edison

887
907
20
18660
20
2) 27360
13680

$\frac{187}{200} \times \frac{4}{2} \times 1.08 = 2.02$

187
108
1516
187
20216

$\frac{1655}{200} \times 4 \times 1.08$

30) 16.55
3.31
1.08
2648
331
6.55) 3.5785 (.590 ohms
3025
5490
5445
450

.59) 11.6 (19.6 mg
59
570
531
390
354

fresh cell

Cu. deposition

Yale Ex

4 cells of Daniell gave
200 deflection 187
2 cells of Bicromate
gave 187
each cell 2.0216 Volts

Wt. Plate 17.9109

4-35 Started
4-40 Warmed 6.050 hms 165-166
4-47 Temp bath 72°F
5-05

18260
17910.9
30) .3491
.01163
11.6 mg

277. in inche gallon

10 gallon

20

20 inches high

138 sq inches base

13 1/4 inches

9624
7000
67 348000 H. lbs

11.2

H

6841
7000
47,887,000
2
95774000 18 lbs H2O

18 | 95774000 (5.32 0000
90
57
54
37

38 | 5320 (141
38
202
198
40

1 HP. 2 2/3 hours to send off 1 lb of H2O in form of gas

5)775
155
9
1395

34462
1395
172310
310158
103386
34462
48,074,690

48,000,000 ft. lbs. given off in burning 1 lb. of H.
96,000,000 ft. lbs. 2 lbs or to make 18 lbs of H_2O.

18) 96000000 (5,333,000
90
60
54

5,333,000 ft. lbs to decompose 1 lb of H_2O

33) 5333 (161
33
203
198
53

161 H.P one minute to decompose 1 lb of H_2O

1 H.P. 2 2/3 hours

$\frac{161}{60} = 2.67 = 2\frac{2}{3}$ hours

1 lb of H_2SO_4 contains 64% of ~~H2S~~ acid at lead concentration ~~sp~~ concentrated contains 98% of acid

of contains 64% of acid

36% of H_2O in dilute acid to make 1 lb of acid at 98% how many lbs of acid H_2O must be driven off

1 lbs. of H_2O about for 3 lbs of acid

5,000 lbs of H_2O for 15 000 lbs of acid

500 H.P working all day to concentrate as much as one still

Pt. still will concentrate 20 000 lbs of brown sulphuric

20000
.78
156 00000

15 000 lbs of 98
15,000 lbs of concentrated acid

112 · lamp

105 · Ohms

120 on 105

~~105 ;;;;;~~ ;

112 ;;; 120 ;;; 105

105

600

120

112) 12600 (112

112

140

112

280

28.5

83.5 Ohms

112) 83.5 (.746

784

510

448

720

~~87~~ .749

9

67.41

~~200~~

83.5) 198800 (2381

1670

3186

2505

6810

6670

1400

2381) 3300 (1.4

2381

9196

9524

84 125 ohms 112 lamp

6

1650

1650

400

6

2000

1600

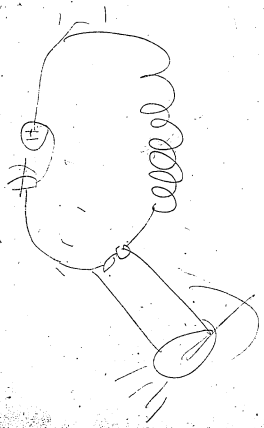
1817

6000

400

6

Tug



Menlo Park Notebook [N-80-10-01] (unnumbered)

This notebook covers the periods October 1880 and February-July 1882. All of the entries are by Edison. Included are notes and drawings relating to lamp caveats, lamp experiments, meters, dynamos, and voltage regulators; notes and drawings concerning the direct conversion of electrical energy from coal; drawings and calculations for electric power distribution systems; and notes and calculations about secondary batteries. There is also a list of new patents, dated July 1, 1882. The label on the front cover is marked "Oct. 1880." There is no Menlo Park notebook number on the label. The book contains 238 numbered pages.

Blank pages not filmed: 48-49, 72-79, 94-95, 154-155, 174-177, 184-185, 194, 199-211, 216-238.

Missing page numbers: 181-182, 195-198.

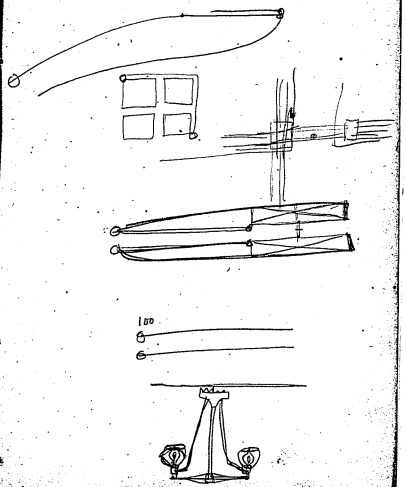
LIBRARY OF THE

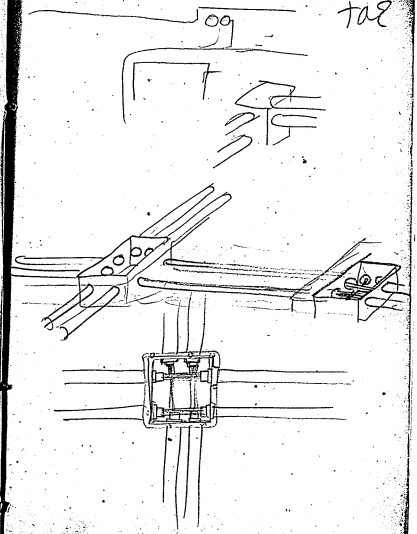
BOARD OF PATENT CONTROL,

120 BROADWAY, NEW YORK.

From Library
GENERAL ELECTRIC
on Broad St. N.Y.
May 1, 1898

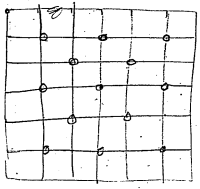
Oct 1 1880

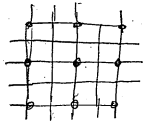




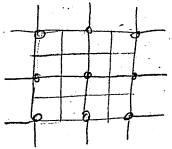
Oct 1. 1880
Tal

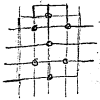
Oct 1 1880
TRE

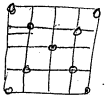


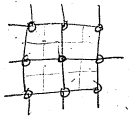


Oct 1 1880
TAE

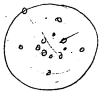






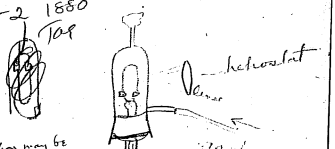


Oct 1880
TAE



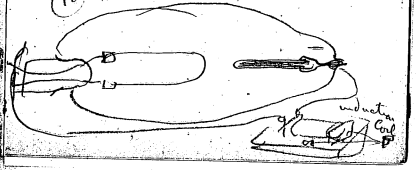
Try the experiments then Cancel

Oct 2 1880
Tag



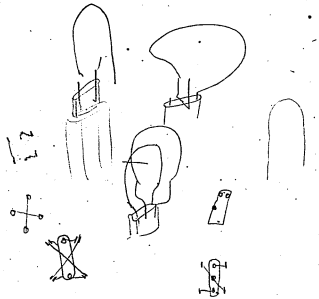
The Carbon may be
boiled in tar & then
tar allowed to dry —
then bulb exhausted &
heated by current or by heliostat focus

Heating the Carbon horse shoe
by a focus of the sun or
Electric light — in vapor of a Carbon
Compound such as gasolene
(10) the volatile paraffine



Oct 2 1880 [A8]

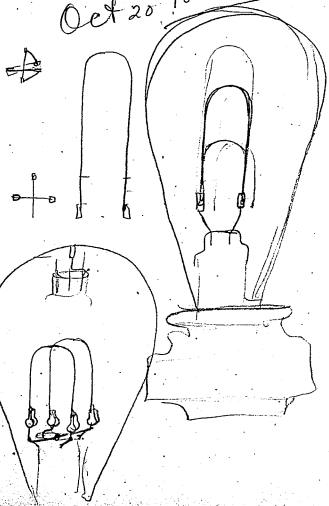
The induction Coil works Continuously. - The tube is Exhausted only partially So that ~~three~~ spark, would be strong - one Electrode is a horseshoe loop ~~[illegible]~~ the other a stick of Carbon - it comes from the stick to the loop & deposits thereon, The stick of Carbon may have tar in it or any thick carbonaceous ~~[illegible]~~ substance Vapor benzin or oil at the Ex haustion used or it may be soaked in. or the tube may have ~~[illegible]~~ a liquid Volatile paraffin or a Vapor or the reduced gas of the vacuum may be a volatile body decomposable to form Carbon



Oct 20 1880
TAE

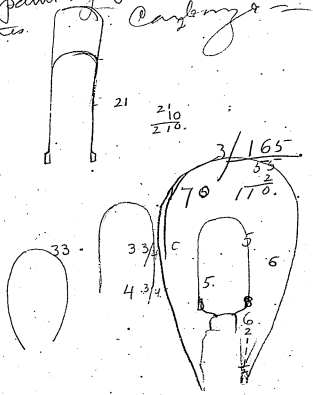
9 perhp 16 — 144
10 12 — 132
12 10 120

Oct 20 1880 TAE



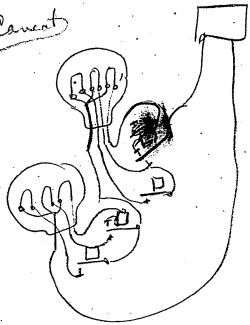
Oct 20 1880

Paint Bamboo with oil
tar dry by gentle heat
paint a gash + thus several
37
Carbonize —
~~bamboo~~

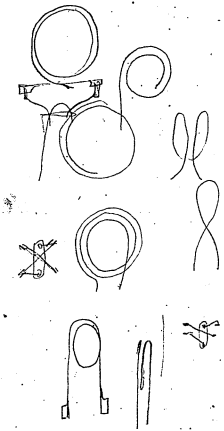


Oct 24 1880 TAE

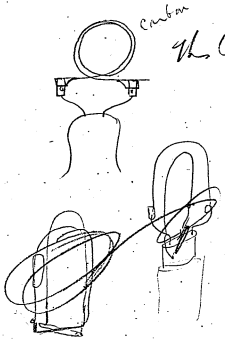
Caveat



~~Mult~~ lamps in series
with multiple carbons &
magnets so that if one
carbon in a lamp burst and
one burns out & so on
burst another & so on
No prevents one lamp
interfering with another

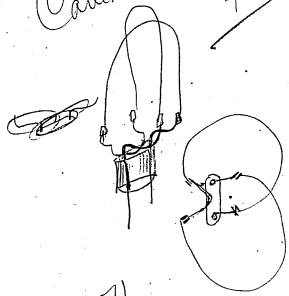


Oct 24 1880



Caveat Oct 24 1880

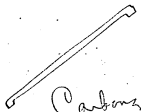
TOE



Thus

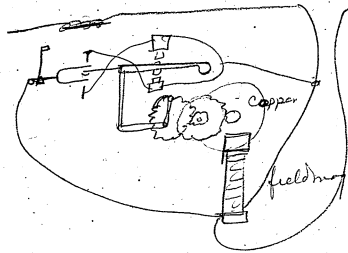
Caveat

Oct. 24 1880
Tal



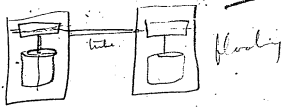
Carbonized thread + then bent + put in clamps

Try the Experiment of putting a Carbon in a compressed almosphere of a volatile gasolin + bringing to incandescence to deposit Carbon on loop also in a rarified almosphere of oil to manufacture Carbon with Lister's surface operation economy



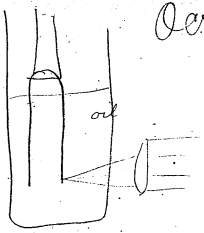
Meter Oct 2 1880

Oct 2 1880



Meter

Oct 2 1880
TQ



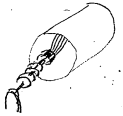
bumeding gut Ende

Oct 2 1880
Tal

Impregnate the end of a loop with silver salt or leaf silver then bring to Incandescence to make it melt & run in, by platinum also salts of ditto, The old plan or Carburizing by heat with Salts these Methods is N.G. Electrical Incan is the boss —

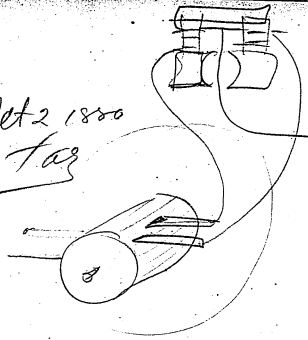
Oct 2 1880

TAE



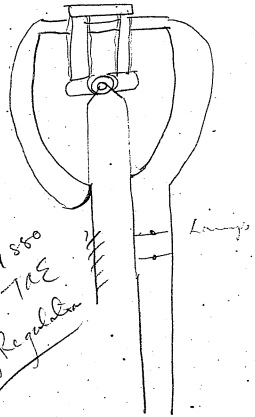
Wind a bobbin for Dynamo with 4 distinct & seperate layers, & connect Each with a Commutator so 4 distinct seperate ckts can be had from one machine — 1 of these may be used for the field — or a single layer of wire could be funded up in seperate Closed ckts each provided with a Commutator.

Oct 2 1880
Tag



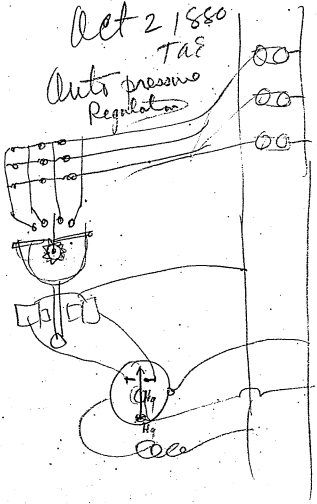
utilization for running the field
of the little Current at the
neutral "point"

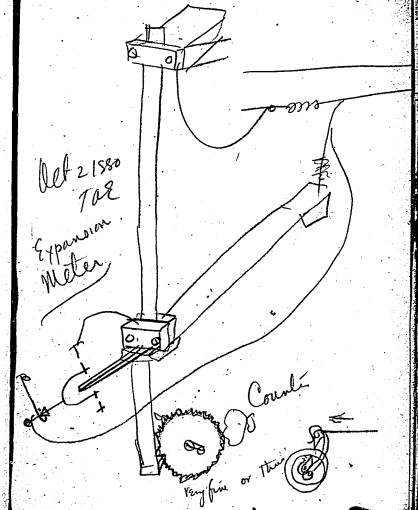
Double Coils



Oct 2 1880
TAE
Self Regulation

Oct 2 1880
TAE
Auto pressure
Regulator




Oct 21 1880
TAR
Expansion
Meter
Counter
Very fine or Thin

Oct 10 1880.

Fig.

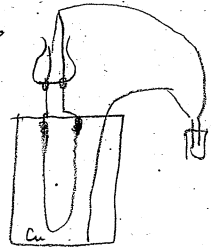
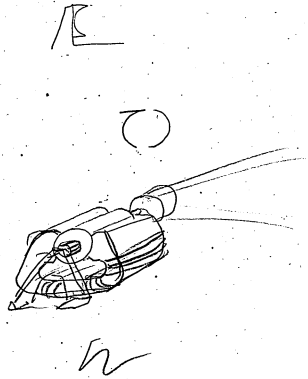


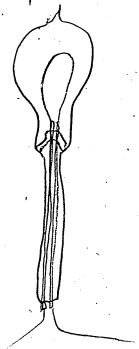
plate Carb to clamps

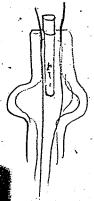
then Eat off Cu from Carbon
by acid Except at Clamps

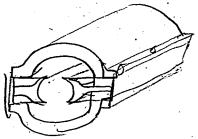


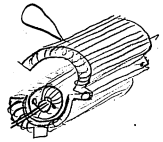
July 5 1882

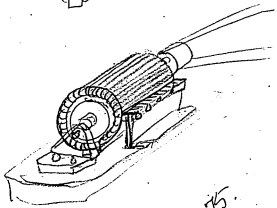
Make a lamp with 8 inches platina leading wire sealed in tubes for leading in wire











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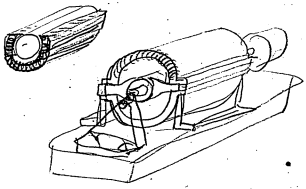
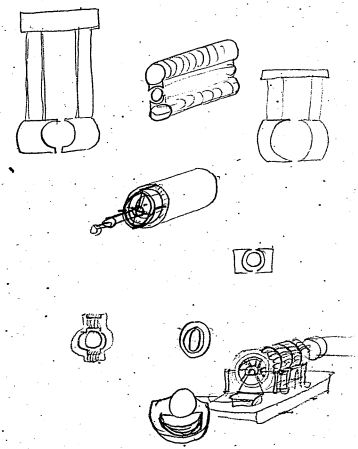


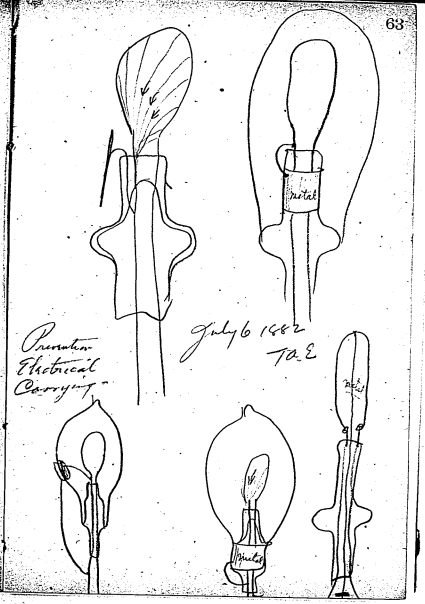
3 4

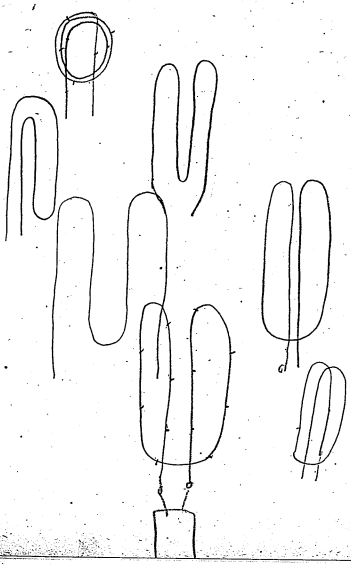
450. 27 900 243 000

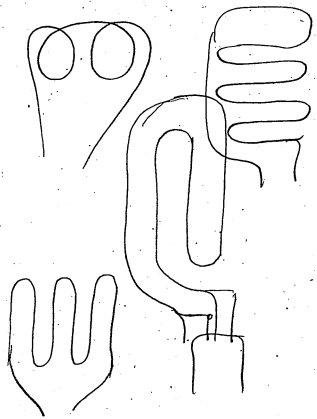
12.

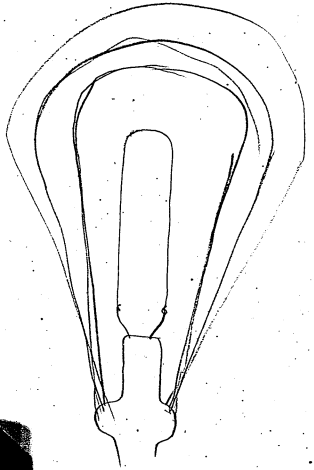
15 00
12
3 00
1 5 00
18 00

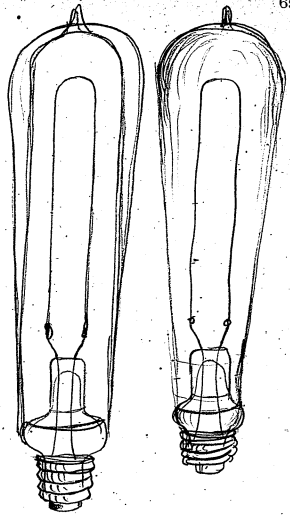


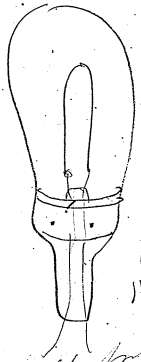

metal
July 6 1882
T.A.E
metal







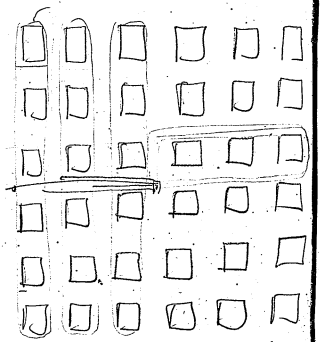




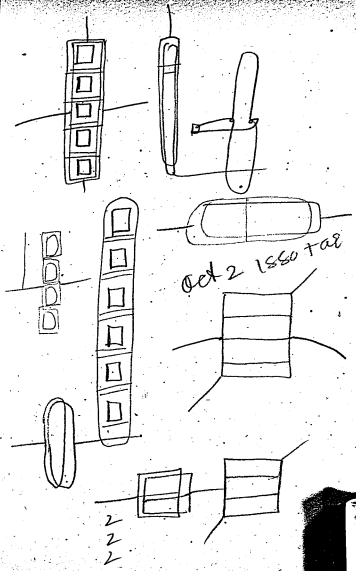
July 5th
1882
Tes

Inside plat
+ outside
both connected
together by wires
through the glass

Presented to Electrical Congress



Oct 2
1880 Tar



129
129
1161
258
129
66641
44
66564
66564
7322 04
200 / 3660
3294 0

129.

3168, Energy

900 Pumps.

3000.

120.

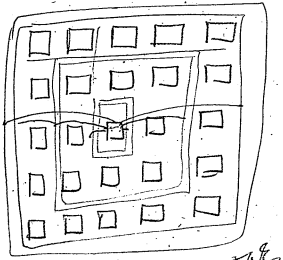
12 volts

120
120
2400
120
14400
44
576 00
576 0 0
576 0 00
200 / 6336
316 8
8
253 44

125
125
625
250
125
15625
44
62500
62500
62500
200 / 6875
3437
9
30936

128
128
1024
256
128
16384
44
65536
65536
200 / 720896
3600
9
3214 00.

Oct 2 1880 THE



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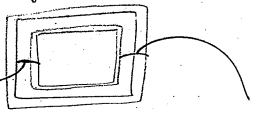
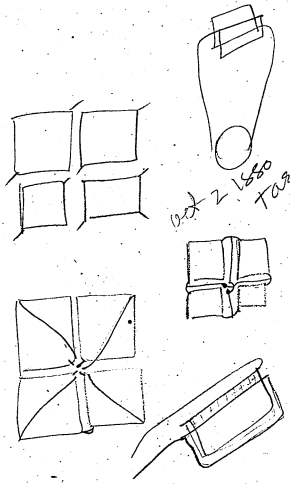
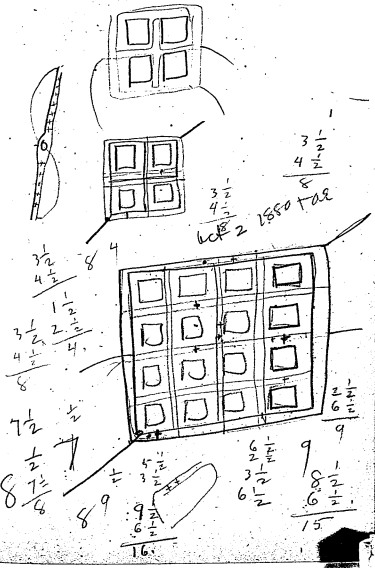
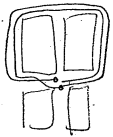



Oct 2 1880
Tue

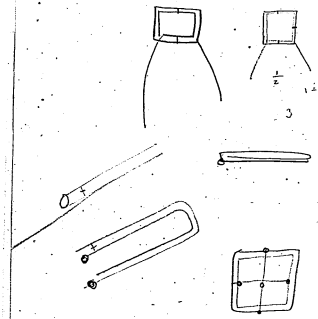

Oct 2 1880 Tue

16+
16−

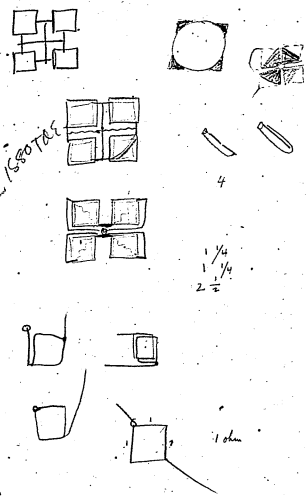


2 4 1/4 5.

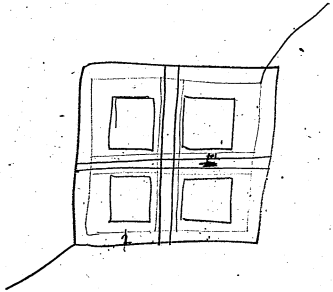
Oct 2 1880 Tue



Oct 2. 1880 TOE



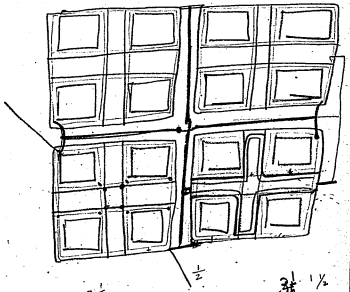
Oct 2. 1880 TOE



$\frac{3\frac{1}{2}\ \frac{1}{2}}{4}$ $3\frac{1}{2}$

$\frac{3\frac{1}{2}\ 1\frac{1}{2}}{5}$

Oct 21 1880 Tag



4. $3\frac{1}{2}$ $\frac{1}{2}$ $3\frac{1}{2}$ $1\frac{1}{2}$

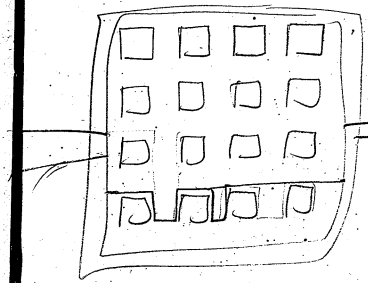
5

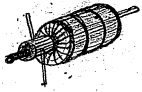
4

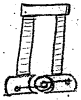
Oct 21 1880 Tag

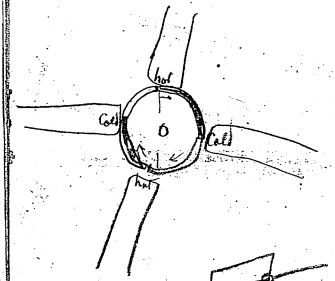
$3\frac{1}{2}$ $1\frac{1}{2}$

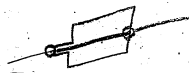
Oct 2 1880 + ae

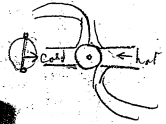






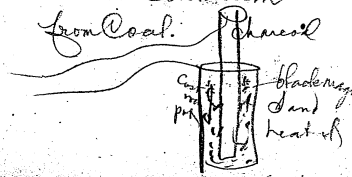


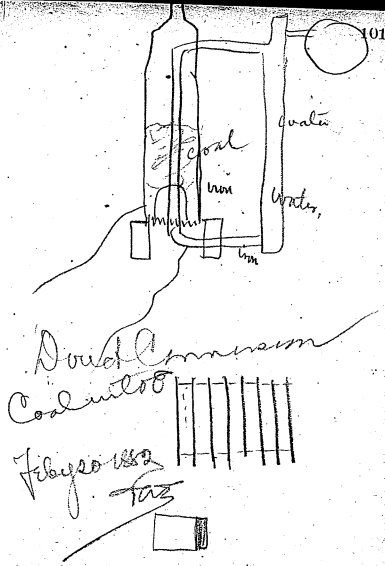




Tray of gas

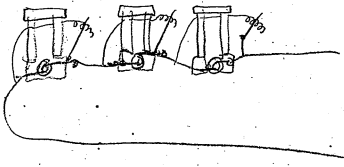
Direct Conversion from Coal.

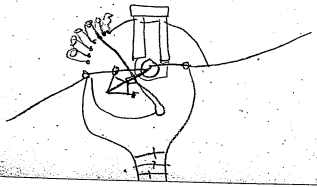



coal
iron
water
water
tin
Double Ammonium
Cobalt
Tobyco 1882
Tar

May 12 1882 TAE

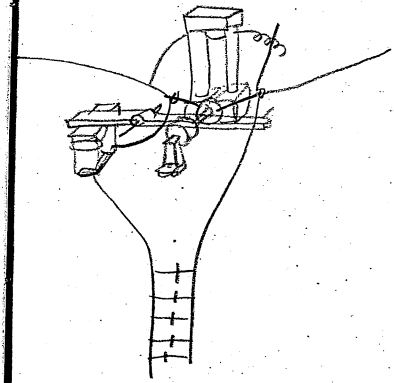
Reducing EMF.





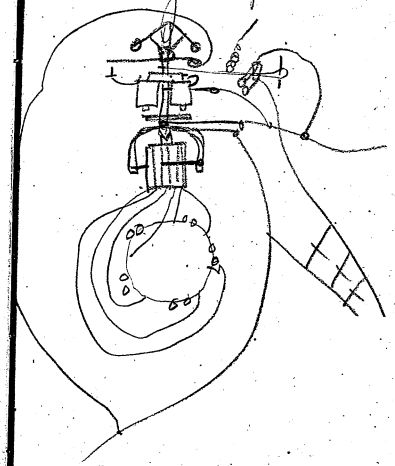
May 12 Tue 1882

Reducing EMFs -



May 12 1882 T.A.E

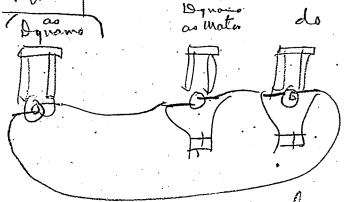
Reducing EMfs —



May 12 1882 402

Tried today plate lead on pole plate compressed peroxide lead other pole as secondary battery, works Elegantly. Zinc pole to peroxide,

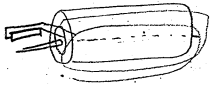
Try EMF reducing Experiment today



Worked Splendid over

See page 111

Present Logan Hughes
Dyer. Indell. Fred.
& Dynamo man. T A E



Improvement on Dynamo bobbin
to reduce spark double up the
number of Commutators
bringing ~~the extra~~ ones from the
other end through the bobbin (B)
the bigness vitra & alleinate
as front with a back connection
with Commutator block.

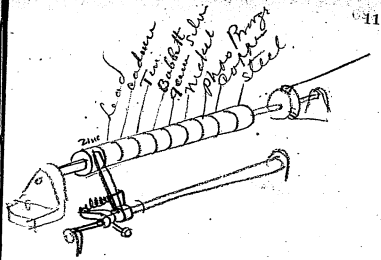
May 12 1882 T.A.E.

I am now trying to make Commutator bars of solid amalgam by plating (15) depositing the metal Electrolytically in the presence of a mercury salt so it will be continuously amalgamated as it is deposited, this will prevent sparks under the constant putting of Hg on the Commutator nuisance

May 12 1882

Make battery by using pole of peroxde Copper other pole ~~pero~~ Iodide ~~of~~ Copper,

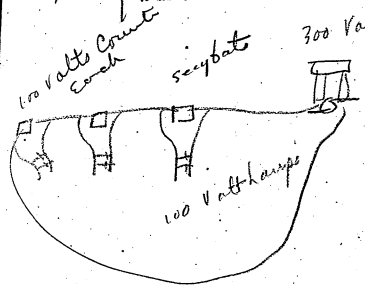
also try lead plate + peroxide lead plate of Moulded peroxde only in Solution of Acetate Lead or other Solubble Salt of Lead



May 12 1882

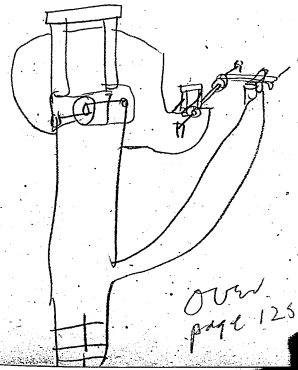
Apparatus used for determining the resistance of contacts on surfaces at high velocities for Commutators of Dynamo Machines

Reducing Emf
May 12 1882



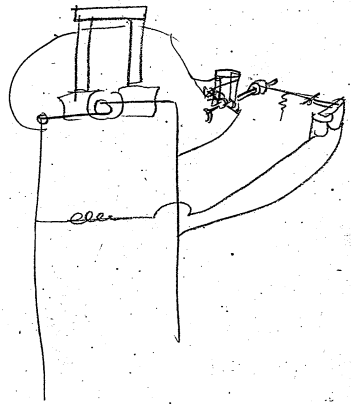
May 12 1882 702 –

Regulating field of force magnets in Isolated Dynamo ~~att~~ automatically.



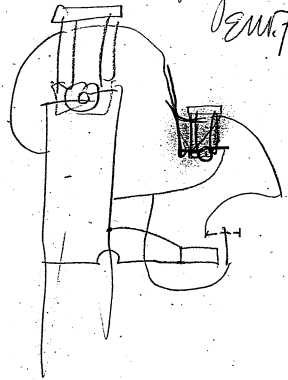
over page 125

May 12 1882 TOE

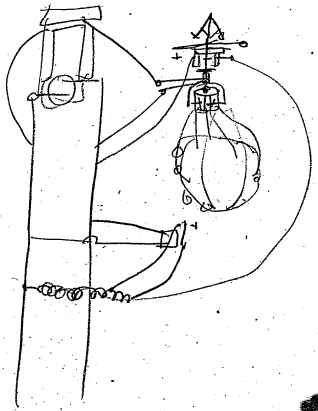


May 12 1882 402

Regulating E.M.F.



May 12 1882 749



May 13 1882 TAE

Secondary Battery

We now make plates of spongy metallic Lead pressed up into plates, work them up - make the metallic Sponge by precipitating hot Chl Pb or acetate Pb by Zinc or iron wash and press -

propose to make pyrophoric Lead which will be finer & use that making it now,

Find that Zinc SO_4 N_2O & a plate of pressed peroxide Pb makes fair battery

also put a carbon in a porous cell & packed around it peroxide lead in outside cell was Zinc & various fluids works pretty fair –

am punching out a lead plate with square holes and fill these with spongy lead obtained in the chemical way

May 13 1882 ~~1882~~.

Propose also to place in the Centre of the holes a disc of zinc ~~[illegible]~~ less in thickness than the lead plate then place whole plate in a solution of a lead salt & allow the zinc to be all used up in throwing down & filling the holes full of spongy metallic lead afterwards washing by displacement.

May 13 1882 TAZ

Also going try Copper plate using iodide copper ~~Sulph~~ on the holes of the Copper plate or around it - acidulating with HCl & other reagents.

106 | 1150 | 10.8
106
900

106
1
106
106
1166

.10

.025
100
2.500

25
50
1.250

136

12 | 800. | 66.
72
80
72

70
35

2
4

17

at 1150

100

1/10

.170
13
1.83

62 -

10 ohms.

62 | 1150 | 17
1
62
430
4

50
5

24 | 300
150

.15

62 | 106 | 1.7
62
440
434

10

6.

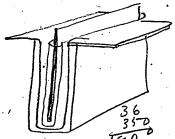
150
30.00

106 | 1150 | 10.8
106
900
4 8

5

120
15
1200
3000
15
18000

1150
183
967



12
350
60
36
00

36
350
80
108
12.600

125 | 1300 | 10
125
5 00

20. Zinc
125 Cop
3 ohms

12

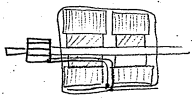
20

144
4
576
1152

650

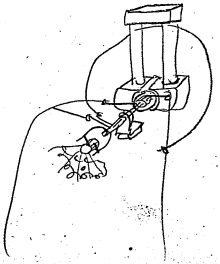
1300

May 13 1882 T.A.E.

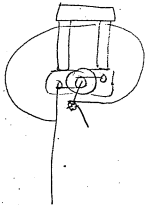


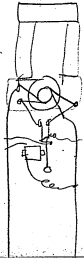
With the regular wound armature instead of connecting the armature wire with the Commutator at the Ends leave a space in the iron & connect in the centre running wires through the wood core to the Commutator cutting out place in the field - by this method 3 times the ordinary number of Commutators may be used on a single layer or double layer machine.

as is now used hence the diffrence of EMF between the bars may be made so small as to almost prevent the spark. and thus save great trouble,

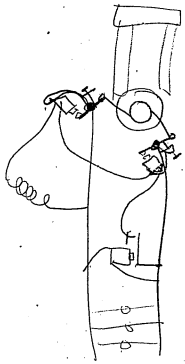


May 13 1882 TAE



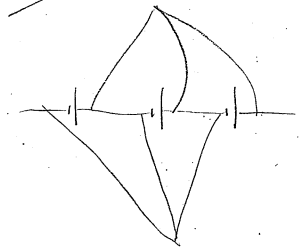


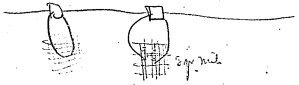
May 13 1882 TAE



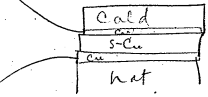
Reg of
Emf for
Isolated

May 13 1882





May 13 1882

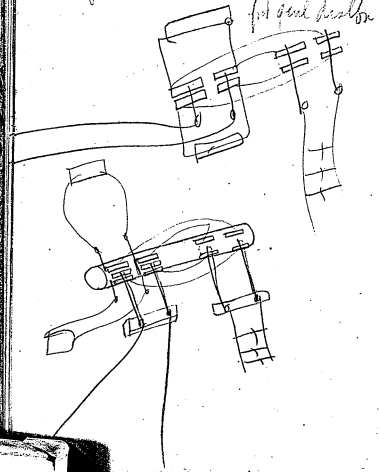


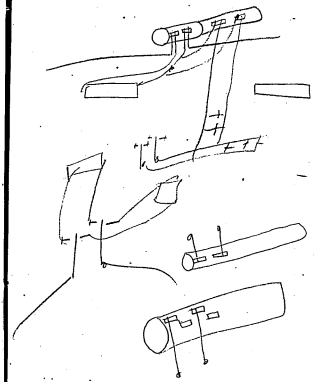
20.

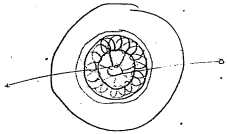
920

June 10 1882
9 A.M.

Hand Cardiac
for open heart







July 1 1882

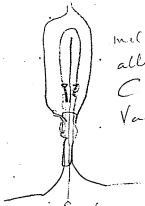
New patents - Tate

Feeder System for small Brown & wet attachment,

Mixing wood pulp etc fibre with particularly oxidized Linseed or other drying oils drying & forming in sheets by Hydraulic pressure after removal stamping or punching & cutting out filaments, before punching etc. baking -

Carbon monodes made out of gas retort Carbon by burning etc. depositing Carbon on highly heated porcelain - polished lime plates, magnesia etc. or depositing on platinum nickel. peeling off punching filaments.

Heating filaments under ordinary pressure in presence of a gas containing Carbon

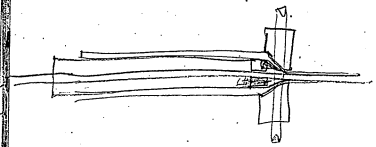


mixed ~~[illegible]~~ to alternate ~~[illegible]~~ Charged Carbon Vapor

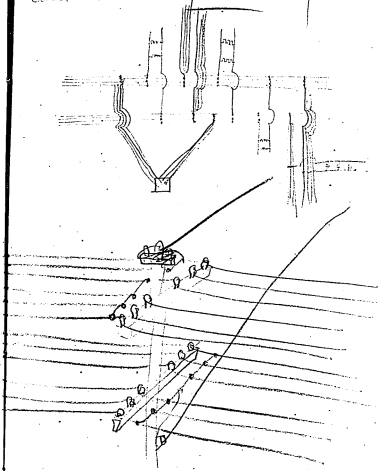
Earth or in air or to one pole

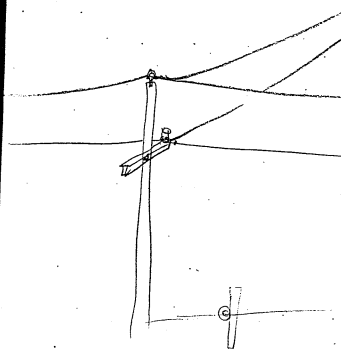
Making mount of ring core

Consolidating of Coating with ~~[illegible]~~ drawing through Japan varnish baking recoat again ~~[illegible]~~ C Urea baking + Soft - cloth or paper ring



for used, molesaid a bolsh
Cotton brand or wounding -





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13

130
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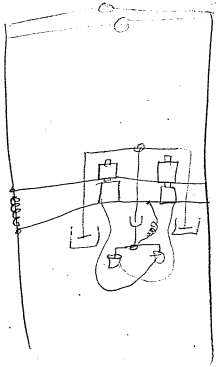
70

Meter July 2 1882

Tag

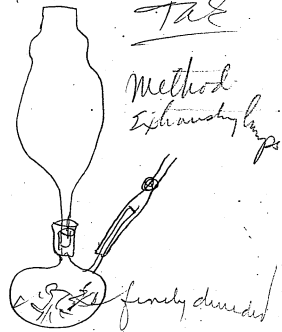


defective

July 21 1882

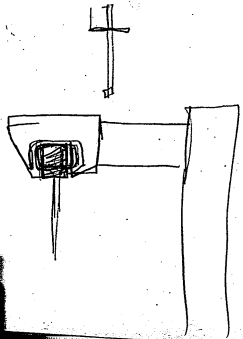
TAE

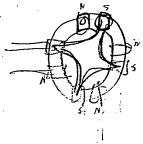
Method
Exhausting lamps

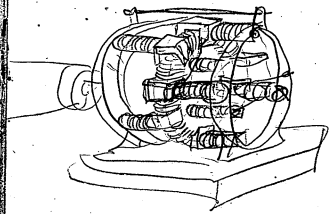


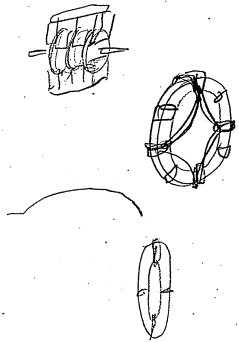
Metal used as Copper

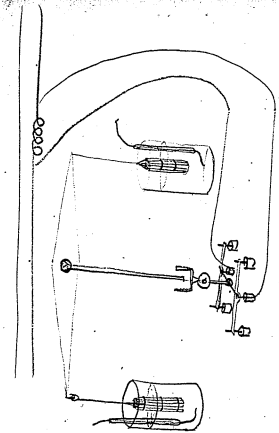
Exhaust lamp with common air pump. then fill with Chlorine. then exhaust again then. pinch off pump and allow finely divided metal to absorb the Chlorine combining with it

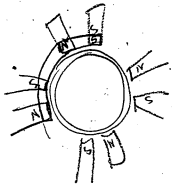








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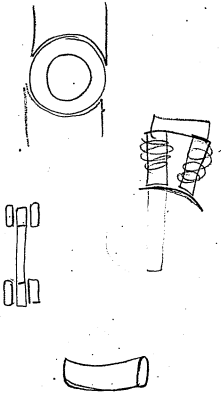

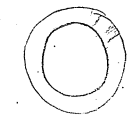

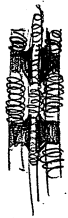

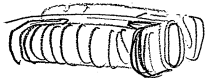

500 / 1350 / 2.7
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3500
3

5.0 / 2350 / 4.70
2000
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3000
70
350000

1000 / 350 / 8150,
3000
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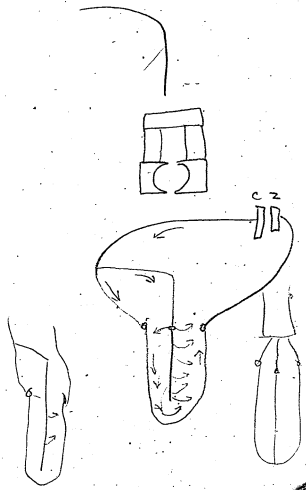

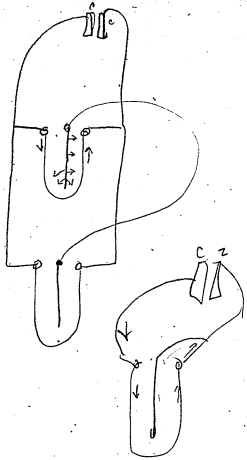
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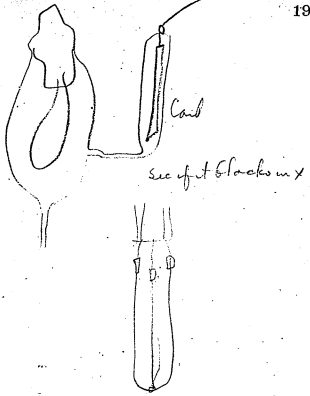
Cord
See after blocks in X
D
D

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150
750
150
225000
44
9000
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2880
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40
2166
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20449
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20800
44000
76000
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3720
2400

Menlo Park Notebook [N-81-04-30] (unnumbered)

This notebook covers the period April-August 1881. There is also an entry for October 1881. All of the entries are by Edison and Charles T. Hughes. Most of the book contains notes by Hughes on experiments to preserve fruits and vegetables in a vacuum. There is also one entry by Hughes on a nickel plating experiment. The entries by Edison include a few notes on his family genealogy and what appears to be an account of a dream. There are also a few miscellaneous drawings by Edison. The left part of the label containing the notebook number has been torn off. The book contains 280 numbered pages.

Blank pages not filmed: 82-89, 98-101, 116-137, 140-147, 152-171, 178-277.

Missing page numbers: 79-80, 173-176.

XE172 N-81-04-30

Exp. 30, 1881

1

Bulb No 1 Strawberries from Florida 3 days en route 1 day in New York. Put on Pump at 10 o'clock P.M. Apl 30th Taken off at 3 A.M. May 1st 1881. 1014 good specimen

Bulb No 2 same as No 1 but left unpicked 48 hours

Bulb No 3 Strawberries got at the same time as No 1 & 2 but exposed to the air 36 hours longer 3½ hours moment exposed to the light. Taken from the Pump May 3rd 1881 at 12 22 P.M.

Bulb No 4 same as No 3

Bott No 5 Sure Florida berries four days picked carefully selected perfectly sound and quite fresh. Pig Kangs carefully. Taken from the Pump at 10½ PM May 7 1881

No 6 Same as No 5. But wrapped in Tissue Paper.

No 7 Strawberries four days picked sealed without exhausting at 3½ AM May 1st put same time as No 1 & 2

No 8 Same strawberries as Nos 5 & 6 exposed to the air while 5 & 6 were being exhausted. Pick on Pump at 10½ PM May 7 1881. Taken off at 1.05 AM May 8 1881 2½ hours vacuum tray fair

No 9 same as No 8 but
vacuum not so good,

Bulb No 10 strawberries,
four days bottom put on
Pump without Phosphoric Chamber with
straight tube instead of
crook. Got good vacuum
in 7 hours. Took off
Pump at 4½ PM May 30th 1881
Berries very fine.

No 11 Charleston strawberries very fine with a
few specks on them. Put on Pump without
Phosphoric straight tube
at 2 PM. May 4th 1881
Taken off 6 " " "
at 6 PM vacuum fair.
No 12 same as No 11

No 13 same strawberries as No 11 & 12 sealed without exhausting at 4 PM May 11th 1881.

No 14 same berries as 11 & 12 & 13. Pulse on Pump at 6 50 P.M. May 11th 1881 Pulse off at 8 50 PM vacuum very fair. Berries looked quite fresh and bright

May 5th 1881

Experiments with Tomatoes

Bulb No. 15

Two Tomatoes fully ripe six days picked. Picked green at Bermuda Island. Put on pump at 8'5 PM. May 5th 1881. Taken off at 8 45 PM with skin burst. ed. sealed and put away.

Bulb No 16.

One large perfect tomato of same lot put on at the same time. Taken off with skin burst at 8'0 PM May 5th 1881

Bulb No 17

Two small ripe tomatoes of same lot burst at same time. all three with straight tubes

No 18

Female of the same lot Put on at 9 hrs PM Taken off bursted at 10 30 PM May 5th Cut Ins

No 19 June 6 18 put on at 10 30 PM Cut tube bursted and filled with silk bubbles at 11 PM May 5th 1851.

No 20 Same as No 19 bursted at 11 30

No 21 Same Females sealed without exhausting.

No 22 Same

No 23 Same

May 6th 1881

Bull No 24 Alnwick Grapes
Tulley wipe stalk without
exhausting at 7½ PM
May 6th 1881

No 25 same as No 24.

No 26 same Grapes put
on Pump at 7½ PM
straight tube, make first
an appearance. Taken off
at 8½ PM May 6th 1881.
Passage stopped by a Grape.

No 27 same Grapes put on
at same time. Taken off
at 9 PM, Vacuum perfect.

No 28. Put on Pump
at 8½ PM. Taken off 11 PM.
Bulb which should have
been No 29, burst into
a thousand pieces after
being on the Pump two hours

No 29 Lunch chop.

Good specimen - in fine condition. Taken off Pump at 9 PM May 9th 1881 Sent to G. E. Gourand.

No 30 Porterhouse steak

The heart specimen was a little dark colored on one side as it was on outside piece. Sent to G. E. Gourand.

No 31 Sand snipe that had been on fog in NY when it reached New York it could hardly be called fresh. Had quite a gamey odor to say the least. Sealed in cloth specimen May 12th 1881 at 8 PM

No 32 same seeds as
No 31. Put on Pump at 7 30 PM. Taken off 9 30 PM
May 17th 1881

No 33 English Plover got at the same time as the seeds. Put much fresh seeds. Probably Grenich Chip had not been picked
Put on Pump at 7 30 PM
May 17th 1881. Taken off at 11 00 PM. Put in vacuum and sealed with air in

No 34. Same as No 33 but sealed without exhausting.

No 35. Strawberries from Charleston. Just quite fresh. Put into Bottle containing a little distilled water boiled in boiled. Put on Pump at 8 m Pm. Taken off at 9 m Pm May 13th 1881 very nice

No 36. Same berries under same conditions as No 35 Put on at 8 m Pm Taken off at 10 m Pm. May 13th 1881 Vacuum not very good. Pump defective.

No 37 Same berries with less water in bottle put on Pump at 8 m Pm Taken off at 10 m Pm May 13th 1881 Vacuum good berries very full in appearance

No 38 same berries that little distilled water. Put on Pump at 10 30 PM. May 13th 1881 Taken off at 12 00 May 1881 Berries very fine and fresh in appearance.

May 23d 1881

No 39. Delaware strawberries two days picked & quite fresh and perfect. Put on Pump at 7 00 PM. Taken off at 8 30 PM May 23d 1881 and put away in a dark place Vacuum 1½ hours and very good.

No 40 same berries. Put on Pump at 7 00 Taken off at 9 15 PM. Vacuum very good Pump took work as well as the other. Left exposed to the light

No moisture visible in either No 39 or 40 and both fresh and red in color.

No 41 contains a fine yellow Rose picked early in the Morning of May 23d 1881 and fairly fresh in appearance but the leaves on the bottom especially scorched by the glass. in blower when putting in leaves look brown on side next to glass but fresh and green on the other side. Put on at 9.00 P.M. Taken off at 9.30 P.M. and put away in a dark place. Vacuum very fair. Leaves of Rose curled slightly

No 1 2. yellow Rose without any leaves picked at the same time as No 1 quite fresh. Put on Pump at 9 00 PM. May 23d 1881 Taken off at 10 00 PM and left exposed to the light

No 1 3. Same berries as in No 39 & 40 Put on Pump at 9 30 PM. May 23d 1881 Taken off at 10 30 PM. Exposed to the light Look fine and red in color. No 1 4 H Same berries as 1 3 put on at 10 00 PM. May 23d Pump No 1 working finely Taken off at 11 00 PM May 23d 1881 Berries look and red No moisture exposed to light.

No 45. Same Corrie as No 44
Put on Pump at 11 PM
May 23rd 1881. Taken off
at 12 30 AM. May 24th 1881
Mercury stopped running
on account of bend in
tubing and got into bulb.
Partially exhausted
again and sealed off.
Caution! Don't eat.
Vacuum fair. Both Corries
have mercury in them.

1746. Fairly fresh berries
Put on Pump at 7 PM
May 26th 1881. sealed off
at 7 PM and Nitrogen
introduced. Vacuum very
fair until replaced by
Nitrogen. Berries look
natural and well. No
Moisture in the bulb.

1747 same berries Put
on at 7 PM. Sealed
off at 8 PM. May 26 1881
and bulb filled with
Nitrogen obtained from
burning Phosphorus in a
Bell Jar. Berries well and
fresh. No Moisture in bulb.
Leaves turned slightly
brown. Put away in the
dark.

No 48 Same Berries as in No 46 & 47. Put on Pump at 8 hrs PM. May 26th 1881 Taken off at 11 hrs PM Good vacuum. No ~~light~~ Nitrogen. Put away in a dark place. Berries quite fresh. No moisture in bulb.

No 49. Same Berries as No 48 kept on Ice over night. Put on Pump at 8 hrs AM May 27th Taken off at 9 hrs and filled with Hydrogen. a little moisture in bulb and berries not very fresh. Put away in dark place.

No 50. Same Berries Kept
over night on Ice. Put
on Pump at 9 30 a.M.
Taken off at 11 30 a.M.
Berries not very good
and some moisture on
bulb. One small Berry
No 51 is quite green. Exposed to
Gas
Tuesd. ex 50. Put
out Pump at 9 30 a.M.
Taken off at 11 50 a.M.
May 29th 1881. Berries
not in very good shape.
Leaves all wilted before
bring put on Pump
Kept in dark Place
Some moisture in bulb

May 26th 1881

Bet the Dinners with
Merill that Tuesday was
the 25th 1881. Lost and
paid little a man and
only repeat of it to
remark that my dates
were somewhat mixed
and that my first
Experiments with Nitro-
gen and Hydrogen were
on May 24th 188 instead
of May 26th and changed
the Bulb No 46 May 24th 1881
7 45 PM

No 47	May 24th 1881	8 45 PM
No 48 "	24th 1881	11 55 PM
No 49 "	25th 1881	9 15 AM
No 50 "	25th 1881	11 20 AM
No 51 "	25th 1881	11 50 AM

May 26th 1881

No. 52. Fresh berries same of three hardly ripe. Put on Pump at 2.00 PM sealed off at 3.00 PM and filled with Nitrogen leaving amount of moisture on glass. Look very fine Left exposed to light

No 53 Same berries as in No 52 Put on at 2.15 PM Taken off at 3.30 PM May 26th 1881 very good specimen. Berries look fine. No moisture on bulb. to speak of.

No 54 Same berries as in 52 & 53. Put on Pump at 3.00 PM May 26th 1881 Taken off at 3.45 PM. Look very fine. Scarcely any moisture in bulb left in sat

No 55 Same Berries put on at 3 30 PM May 26 1881
Taken off at 5 PM May 26
Sealed by Mercury

No 56. Same Berries put on at 3 40 PM May 26 1881
sealed off at 4 40 PM with good mercury and bulb filled with Nitrogen. Left exposed to the Light

No 57 Same Berries put on Pulsep at 4 30 PM May 26 1881
Taken off at 5 30 PM. and filled with Hydrogen.
Berries appear pale and red in color a little reaction in bulb. Left in dark

May 28th 1881

No. 58. Fresh Tissues. Put on Pump 3^40 PM. May 28th partially exhausted and bulb filled with Hydrogen and exhausted again. Refilled with Hydrogen and sealed off. at 4^40 PM May 28th 1881

Tissues fresh in appearance. A little of the original moisture on the glass. Left exposed to the Light.

No 59. Same Tissues put on Pump at 4^50 PM, got good vacuum and sealed off and introduced Hydrogen. Sealed off 5^10 PM May 28/81

Lack vacuum.

No. 60 Same Tubes Put on Pump at 6 30 P.M. May 28th 1881 partially exhausted and filled with Hydrogen and exhausted sealed off from Pump and re-filled with Hydrogen and sealed off. Tubes Test and red Taken off at 7 45 P.M. May 28th 1881 Lost Vacuum by explosion

No. 61 Same Tubes put on Pump at 6 30 P.M. Taken off at 7 10 P.M. May 28th 1881 No Hydrogen. Vacuum fair Tubes Test and red but a little moisture on bulb. Left exposed to the light.

May 28th 1881

No 62. Put on Pump at 7 50 PM May 28th 1881 got fair vacuum sealed off at 8 50 PM and filled with Hydrogen. Berries very fresh and Nourishing to speak of in bulb. Put away in a dark place.

No 63 same berries. Put on Pump at 8 50 PM. exhausted and filled with Hydrogen. Sealed off at 10 50 PM May 28th 188. Fresh and good. but little moisture in bulb. Put away in a dark place.

May 31st 1881 47

No 64. Strawberries fully ripe. Put on pump at 7 30 PM. Equal quantity of solution of Salicylic acid composed of 5 grains Sal. acid to one tumbler full of water. Taken off at 11 45 PM. May 31st. Put in dark. Berries quite fresh in appearance.

No 65. Cartons Butter made by Mrs Stillwell to day. Put on Pump at 3 10 PM. Taken off at 4 10 PM. May 31st 1881. Butter kept on ice until wanted for exhaustion. got very good vacuum. Same matter in bulb.

Put away in the dark

No 66. Same Berries. Same solution. Put on Pumps at 4 10/11 PM. May 31st 1881
Taken off at 5 10/11 PM.
Berries look pretty fair
Left exposed to light.
Vacuum good.

No 67. Same Berries and Solution. Put on Pumps at 4 10/11 PM. May 31st 1881
Taken off at 6 10/11 PM.
Look well. Left on Ice while others were being exhausted.
Left exposed to the light.
Berries fair but quite moist.

No 6 8 ~~May~~ June 1 1881

Brick Berries in bulb containing 10 grains Salicylic acid dissolved in a tumbler of water. Put on Pump at 12 50 P.M. Taken off at 1 30 P.M. Liquid boiled 30 minutes after being put on Pump and continued to for about ten minutes and stopped. Took good vacuum. Berries much shut Great looking. Exposed to the light.

No 69 same Berries put on and taken off Pump at the same time. Exposed to the light.

No 70

Same Berries and solution as 68 & 69. Kept on Ice while 65 & 69 were being extracted. Put on Pump at 7.30 P.M. Taken off at 11.00 P.M. June 1st 1881 and put in a dark place. Liquid in bulb boiled 30 minutes after being put on Pump stopped in a few minutes. Got good vacuum. Put away in the dark.

No 71 Same as No 70. Put on Pump at 7.30 P.M. Taken off at 11.0 P.M. Liquid boiled as in No 70. Berries dark green but are quite moist. Put away in the dark.

No 72 Cantaloupe Fresh green
Was Put on Pump at 12 Hrs 15 Min P.M.
Taken off at 2 Hrs 00 Min P.M. June 6th 1881
Was perfectly dry and
the same color when put
in a whitish green

No 73 String Beans. Put on
Pump at 12 Hrs 15 Min P.M. June 6th 1881.
Taken off at 2 Hrs 00 Min P.M. Beans
perfectly dry and same that
shriveled but quite green
in color.

No 74 Peas same as in No
72. Put on Pump at 2 Hrs 00 Min P.M.
Taken off at 4 Hrs 10 Min P.M.
June 6 1881. Look fresh as
when put in and perfectly
dry. Vacuum not good
Pump would not work

No 75 Same Prac. Put on pump at 7 00/00 PM. June 6th 1881
Taken off at 5 30/00 PM.
Dry and fresh looking.
Vacuum good

No 76. Same Prac. Sealed with out exhausting. at 4 00/00 PM. June 6th 1881.

No 77. Georgia natural Peaches
Hardly fully ripe but in
fair condition. Put on Pump
at 7 H 30 PM June 22d 1881
Taken off at 6 00 PM June 23d
Pump not very good
Vacuum fair slight moisture
on glass.
No 78 Same Peaches as in No
77. Put on Pump at ~~June~~
~~June~~ 8 10 AM June 23d 1881
Peaches just on the point
of decay. one nearest bottom
brown and soft about one
inch in diameter. No moisture
in Jars. Taken off at 12 00 PM.
Good Vacuum in Sealing.
No 79 Same Peaches Put on at
8 10 AM Taken off at 12 15 PM.
Vacuum not very good Pump
not working well. No moisture

No 80 Aug 5th 1881

Small tube Packer quite fresh with common Charcoal put on Punk at 10 20 AM Taken off at

P.M. Brooke

No 81 Same Packer in bulb containing Alcohol Lower end had commenced in it Put on Punk at 10 20 AM Alcohol began to fail in ten minutes after being put on

Brooke

Aug 5th 1881 63

#080 Bubs containing ripe Peaches and Alcohol. Put on Pump at 1930. P.M. Commenced to boil in ten minutes and continued to boil.

#081

Same Peaches in a solution of Salicylic Acid 10 grs. to a Pint of water. In each case the lower peach was almost entirely immersed in the liquid. Put on Pump at 1930 P.M. Taken off at P.M. I boiled

No 80 Peaches and Sugar in bulk. Put on Pump at 1 00 P.M. Taken off at 3 00 P.M. Good vacuum Sugar a little moist Peaches fine in appearance.

No 81 Peaches & Soap. Put on Pump at 3 15 P.M. failed Not enough Vacuum

No 81 Peaches & Salt Put on Pump at 3 00 P.M. Taken off at 4 00 P.M. Vacuum Fair but moisture coming from Peach which is not the thing in Salt

No 82 Leaches in bulb with charcoal put on Pump at 11.50 PM. Taken off at 5.50 PM. Very Good Pack working Pump. Leaches dry and nice in appearance

No 83 Aug 11th 1881

Leaches and Alcohol Put on Pump at 8.30 PM Taken off at 10.00 PM. Vacuum fair. Liquid boiled in ten minutes.

No 84 Leaches & Charcoal Put on at 10.00 PM. Taken off at 12.00 PM. Vac not very good. Pump not working well.

Aug 12th 69

No 85 Peaches & Charcoal
Piece half turned by
standing in warm room
Put on Pump at 3 00 P.M.
Taken off at 5 00 P.M.
one side looks well.

No 86. Aug 12th
Large bulb with Peaches
and Carbonized paper
Put on Pump at 8 45
A.M. Taken off at 7 45
P.M. Same moisture in bulb but peaches look quite good although about five days old.

No 87 Bulb containing Peaches covered with carbolized wheat hulls and sealed at 11.55 A.M. with auch exhausting.

~~No 88 Same Peaches as~~ in No 87 ~~with Solution of Salicylic Acid~~

No 89 Same Peaches with carbolized wheat hulls. Put on Pump at 3.10 Taken off at 4.20 Good Vacuum.

No 88 Same Peaches nothing else Put on Pump at 1.55 PM Taken off at 5.30 PM Considerable moisture in bulb from Peach.

No 90 Aug 17th 1881

Same Peaches with carbonized wheat hulls Put on Pump at 4.20 PM Taken off at 6.00 PM good vacuum.

Aug 19th 1881

No. 91 Peaches and Salicylic acid Put on Pump at 2.00 PM. Taken off at 4.00 PM. Lower Peach showed a wickered appearance in ten minutes after putting on and liquid began to boil. Peach not in contact with liquid. Fresh and good.

No Pump.

No 92 Peaches & Salicylic acid. Put on Pulp at 3 40 P.M. Taken off at 5 30 P.M. Peaches fresh and good. Vacuum good.

No 93 Peaches & Salicylic acid. Put on Pulp at 2 50 P.M. Taken off at 5 20 P.M. Very fair Vacuum.

Oct 20th 1881

Nickel Plating Experiments on the flat sides of rails for perfect contact in connecting. Also plating fish plates & copper bars. Put rail in Sulphuric Acid for half an hour, then in Sulphate of Copper Solution. Then in Nickel Solution.

Fish plates & copper stick treated in the same manner. Worked well.

300

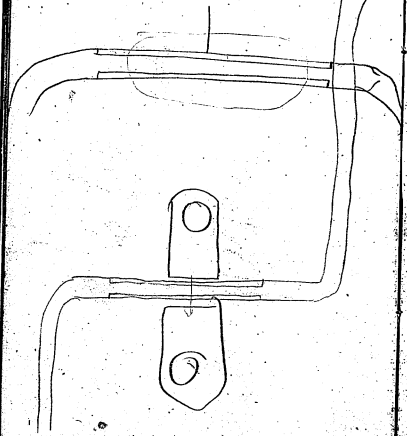
275

.3

25
.3
7.5

175

300



33.000 lb

30

450 | 99000

1983

3 | 2200

70

Scrot

Bals

22000 lb

15

3

11

165

450

22000

11 0000

550.000

183

16

23

1350

1080

270

239.800

79

75

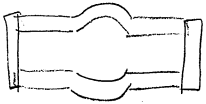
2. 30" 52.80 | 9.

216

30
9 | 65.3680
90
65.3680
90

9 | 65.3680
70.2
2.50

Effi. 10



600 − 50
450 = 1000 / .6 = 170 amp.
1,000
17.000

300
600 − 550

What is efficiency at 23 HP

300 − 25
275 = .3 R amp.

at 250 volts 250 / 3 = 83 amp.

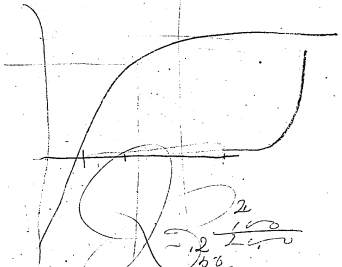
200 = 75 / .3 240
75
1200
1680
746 | 20.75 | 3 HP
25
4.15
36

250 746 | 18.000 | 23.
1492
3080

275 | 2000 | 7
2.00

$$\begin{array}{r} .2 \\ 50 \\ \hline 10.0 \end{array} \qquad \begin{array}{r} .2 \\ 100 \\ \hline 20 \end{array}$$

$$\begin{array}{r} .2 \\ 200 \\ \hline \end{array}$$

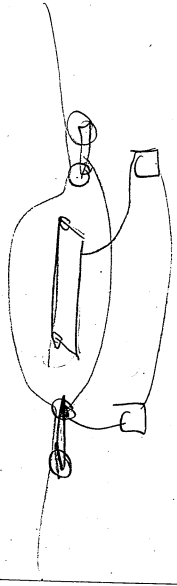


$$\begin{array}{r} .2 \\ 100 \\ \hline 20.0 \end{array}$$

$$\begin{array}{r} -.2 \\ 100 \\ \hline 1.00 \end{array}$$

$$\begin{array}{r} .2 \\ 2.0 \\ \hline 10.0 \end{array}$$

.02

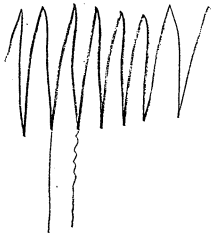


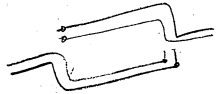
Boulevard St Antoine that damnable
merchants of inhumanity. Citerian
wharfrats Why Centerina don't run a
line already greased from Sirius to
Capella with angularity, ten million
devils slide down to the farthermost
bog and piss into pandemonium
Tell me winged soldier of Hell
of in the farthermost ends of infinity
wanted demons with cavernous
mouths spit saliva on the balls
of ~~[illegible]~~ the firmament to produce
deluges, has seen the grief-errant
he shocks ~~[illegible]~~ the angel of
desolation, amuses himself by
letting off fire works on
powder kegs, Citronella this
damned perfume on the lime
clad hills of Andalusia
wafted as from a garden
filled with Red Hot
giraffes a Rain of Bouchon

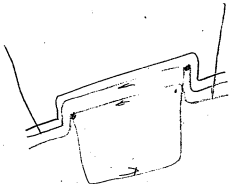
Soup descended on the thirsty
soil and the wells and snake
holes poked ~~[illegible]~~ miasmatic
water from the rudness of the
rapost pruthee tell Centenno
we of the finite minds, of Vesuvius
constipated from derangement of the
Terrassian kidneys will ever
vomit up again ~~to~~ engulf ~~the~~ more Earth lice
They tell me the milky way is
formed of stars + planets so numerable,
+ its diameter so great that
if adam was one and all the
bands of the sea were cystem
they would not suppose a freaptible
acgment of the great ring -
Doth god have a pegasus
+ see the milky way as a
hitching ring
Whizzozzizzum an asteroid
has run plump into ~~a~~ favorite
angel, This Crank

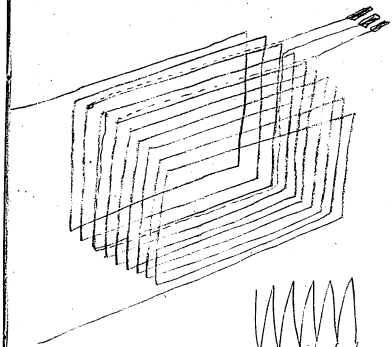
lumps of matter will be used
for a water closet in Hell
two angels at a Candy pull,
they stretch the vicious molasses
from Vega to Saturnus at every
pull, flies as big as Japan
buzzed around it,
a Bowery angel smoking a
palm tree stubbed his toe
on a Comet, and pimples came
out on his toe nail as big as
mountains, he swore so much
that God made Eight new
planets out of the Concreation
& peoples and founded &
floored them. Eccentrically
the almighty has a vein of
humor he make three
planets & peoples them

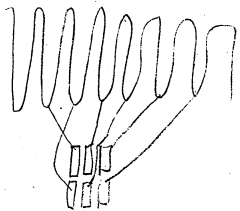
to give announcements to beings on
the rest of the celestial globe [illegible]
The men were 900 miles long
+ $\frac{1}{4}$ inch thick they slept on
telegraph poles, and animals,
with bodies as big as a pea
with 900 eyes each as big as a
ounce lives on these long men
by catching them by the feet or
sucking them in like macaroni,
In the most [illegible]
Dwindle amid [illegible]
More beautiful than [illegible]
Cinnamon, in a palace [illegible]
Gabriel [illegible]
Each endowed with a [illegible]
Capable of [illegible] that which
De Quincey, [illegible] the abram 30 miles
in diameter full of opium would
[illegible]

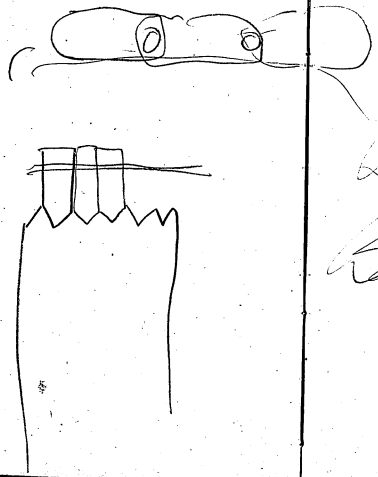








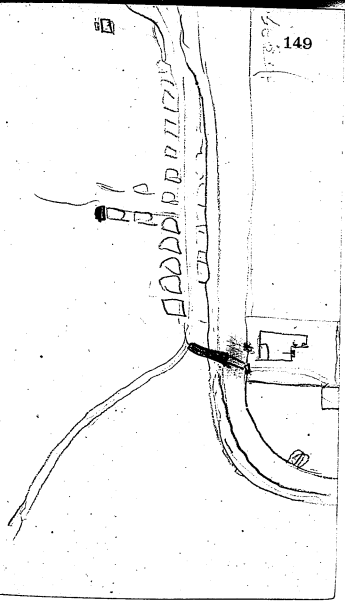




Bals

Bals

Captain Ebenezer Elliott -
fought all through the Revolutionary war
7 years —
Born -
My grandmother Elliott.
was named Mercy Peckham
born in Stonington Conn -
her father was a scotch
quaker —
Capt Ebr Elliott drew his
pension from Buffalo &
lived in Vienna till
death, lived little
over 100 years —



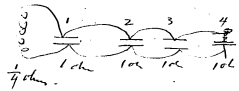
grandfather Elliot had
3 daughters. Fanny. —
Betsey 84 — Nancy — 65
Sons — Stephen, Isaac —
John Elliott,

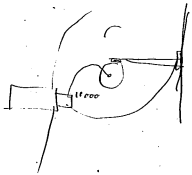
Samuel E married
Nancy Elliott 1828

Isaac 88 yrs —
John 51 yrs
Stevs — very old —

51 — 49.
22
71 —

72


1
2
3
4
1 ch
1 ch
1 ch
1 ch
1/4 ch


1 ch

Sunday June 12th 1881.

Put a piece of cast iron in receiver exhausted the air, heated to bright red heat, and admitted air to enter through the strang and burnished the iron shaving.

Monday June 13th 1881.

Had cast iron shaving put into a lump bulb and exhausted the air with Mercury pump. Let the current through it and heated to a bright red and let air in and exhausted again. Repeated the process three times and took out. Iron was apparently malleable Hammered it flat.

Young

Jesus

Menlo Park Notebook [N-80-01-16] (NOT FILMED)

This notebook was probably used during the early or mid 1880s. It contains entries from January 16 and 17 (no year) by an unknown laboratory assistant. The entries consist of a series of rough notes relating to chemical experiments. In the middle of the book are a few drawings of dynamo armature windings. The pages are unnumbered, and there is no notebook number on the front cover. The book contains approximately 120 pages.

Menlo Park Notebook [N-81-09-02] (NOT FILMED)

This notebook probably dates from 1881 or 1882. It was kept by Samuel D. Mott and contains pasted-in printed drawings from Edison's patent applications. The label containing the notebook number has been torn off. The book contains 280 pages. Approximately half the pages have been used.

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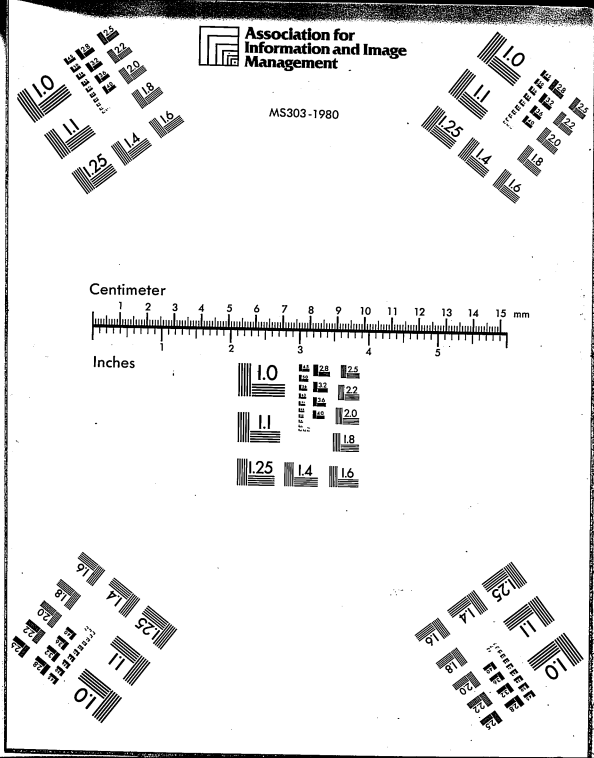
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